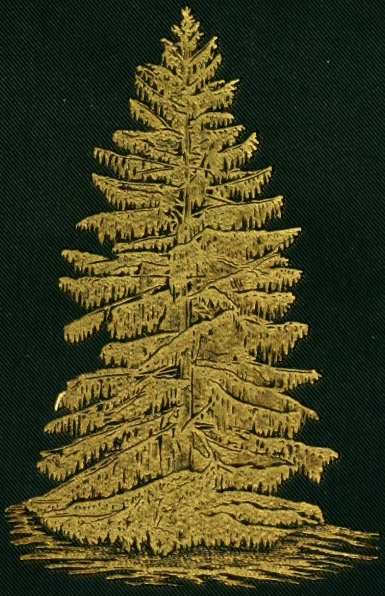
# HARDY CONIFEROUS TREES



A. D. WEBSTER

# HARDY CONIFEROUS TREES

# Hardy Coniferous Trees

*BEING A CONCISE DESCRIPTION OF EACH SPECIES AND VARIETY, WITH THE MOST RECENTLY APPROVED NOMENCLATURE, LISTS OF SYNONYMS, AND BEST METHODS OF CULTIVATION*

**Also Chapters on**

*"The Commercial Aspect of Conifers;" "Quality of British-grown Coniferous Timbers;" "Conifers for various Soils and Situations;" "Conifers of Different Characteristics;" "Propagating Conifers;" "Enemies of Coniferæ;" &c. &c. &c.*

BY

A. D. WEBSTER

AUTHOR OF

"Practical Forestry;" "Hardy Ornamental Flowering Trees and Shrubs;" "British Orchids;" &c. &c.



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# PREFACE

THE following notes on Coniferous Trees, which have been compiled as opportunity offered during the past twenty-two years, are taken in the main from specimens cultivated at Penrhyn Castle, Woburn Abbey, and other places of which the writer has been in charge. To the owners of several well-known Pineta and nurseries throughout the country and on the Continent, I am indebted for specimens and information regarding some of the rarer species and varieties.

Numerous articles, monographs, and essays on Hardy Conifers have, at various times, been contributed by the author to *The Garden*, *The Gardeners' Chronicle*, and "Transactions of the Royal Scottish Arboricultural Society," and from which Professor Hansen in "The Pinetum Danicum," Nisbet in the last edition of "Brown's Forester," Ravenscroft in "The Pinetum Britannicum," and other writers, have done me the honour of quoting. Condensed notes from some of these papers are included in the present work.

As regards general nomenclature, I have followed the now almost universally adopted plan of Bentham

and Hooker, while the synopsis of tribes and genera and lists of synonyms are mainly from Masters' "List of Conifers and Taxads."

The generally accepted names of both species and varieties have received special prominence, and are printed in conspicuous type, while the lists of synonyms have been made as inclusive as possible, owing to many of these being still in common use.

In order to facilitate reference, the arrangement of both genera and species is alphabetical throughout the work.

This book being mainly intended as a cheap, handy, and exhaustive popular guide to Hardy Conifers as cultivated in this country, the descriptions are necessarily brief but nevertheless comprehensive; while, as far as is consistent with a full and clear explanation of each species, technical terms have been avoided.

A. D. W.

BOXMOOR,
HERTS,
*November*, 1896.

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# HARDY CONIFEROUS TREES.

## CHAPTER I.

### CLASSIFICATION AND DESCRIPTION.

### Natural Order CONIFERÆ.

THE conifers (cone-bearers), one of the most important families of the vegetable kingdom, are for the most part evergreen, resin-bearing trees or shrubs. They belong to the Gymnosperms, or naked seeded plants, the ovule being naked on the face of the ovary. The male and female flowers are separate, either on the same tree or on different trees. Stamens in catkin-like masses; female flowers in cones. Seed furnished with a hard, crustaceous covering. Wood resinous, with the ligneous tissue marked with circular discs.

This order may, for convenience, be subdivided as follows:—

I.—CYPRESS TRIBE
(*CUPRESSINEÆ*).

1. JUNIPERUS.
2. CUPRESSUS.
3. FITZROYA.
4. LIBOCEDRUS.
5. THUYA.

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II.—TAXODIUM TRIBE
(*TAXODIEÆ*).

6. ATHROTAXIS.
7. CRYPTOMERIA.
8. SCIADOPITYS.
9. SEQUOIA.
10. TAXODIUM.

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### III.—Fir Tribe (*ABIETINEÆ*).

11. ABIES.
12. CEDRUS.
13. LARIX.
14. PICEA.
15. PINUS.
16. PSEUDOLARIX.
17. PSEUDOTSUGA.
18. TSUGA.
19. KETELEERIA.

### IV.—Araucaria Tribe (*ARAUCARIEÆ*).

20. ARAUCARIA.
21. CUNNINGHAMIA.

## Natural Order TAXACEÆ.

With one exception (Ginkgo), these are evergreen trees or shrubs. Flowers unisexual, mostly axillary and dicœcious. Male flowers in catkins; females naked, solitary, or rarely in twos. Fruit more or less drupaceous, the seed coat being either dry or eventually fleshy. This order may be subdivided as follows:—

### I.—Salisburia Tribe (*SALISBURIEÆ*).

22. GINKGO.
23. CEPHALOTAXUS.
24. TORREYA.

### II.—Yew Tribe (*TAXEÆ*).

25. TAXUS.
26. DACRYDIUM.

### III.—Podocarpus Tribe. (*PODOCARPEÆ*).

27. PODOCARPUS.
28. PRUMNOPITYS.
29. SAXEGOTHEA.

## ABIES (Linnæus).

### THE SILVER FIRS.

Pre-Linnean botanists distinguished the genera Picea and Abies, placing the spruce in the former and the silver fir in the latter genus. Linnæus, however, reversed the terms, and the confusion in botanical nomenclature has continued to the present time. In accordance with the universally adopted plan of Bentham and Hooker, the silver firs are here included under *Abies*, and the spruces under *Picea*.

*Flowers* monœcious; male catkins scattered, axillary or terminal.

*Cones* erect, cylindrical or nearly so, maturing the first year.

*Scales* deciduous, falling off when ripe from the persistent cone-axil.

*Bracts* free from the scales except at their base, and longer or shorter than these.

*Seeds* somewhat triangular, with a large usually wedge-shaped inseparable wing.

*Cotyledons* leafy, entire, flat, and from four to eight in number.

*Leaves* flat, solitary, more or less in two rows, silvery below, leaving a circular indentation on the branch when they fall.

**Abies amabilis,** Forbes. Red Fir. (*Synonyms:*—*Pinus amabilis*, Douglas; *P. grandis*, Lambert; *Picea amabilis*, Loudon; *Abies grandis*, Murray; *A. grandis densiflora*, Engelmann; *A. magnifica* of some gardens.) Fraser River Valley to Oregon. 1831.—This handsome tree is by no means common in the British Isles, probably owing to the confusion which until recently existed respecting the identity and nomenclature of this and others of the North American firs. As an ornamental tree it is second to no other conifer, the easily-arranged semi-decumbent branches with the flattish shoots given off

nearly at right angles, and great wealth of intense bluish-green fragrant foliage, rendering it as unique as it is beautiful. The leaves, which are nearly of equal length, and about an inch long, are densely clustered on the upper side of the branches. They are of a dark, glossy green above, and with two broad glaucous lines beneath. The cones are very beautiful, being of a rich, deep purple, 4½ inches long by about half that in width; while the broadly bell-shaped scales are nearly double the length of the abruptly pointed bracts. The pretty pinky male catkins are quite a feature of the tree in spring. From the nearly allied but perfectly distinct *A. grandis*, it may at once be distinguished by the more crowded, darker and usually shorter foliage, and particularly by the deep purple cones. When planted in suitable soil (the finest specimens I have seen are growing in reclaimed peat bog on an estate in the North of Ireland[1]), this tree is of rapid growth, one specimen in particular, growing under very favourable conditions, having for several consecutive years made an upward growth of fifteen inches.

**A. balsamea,** Miller. Balsam Fir. (*Synonyms:—Pinus balsamea*, Linnæus; *Picea balsamea*, Loudon.) Canada and North-East United States. 1697.—In a young state and when grown under favourable conditions, this is by no means an inelegant species, but before the age of twenty years the lower branches have usually given way, and, in consequence, the tree wears a scraggy and bare appearance. Unfortunately, too, it has the tendency to form early growths, which are not unfrequently destroyed by frost. It is of medium height, and slender growth, with flat regularly arranged leaves, about 1¼ inches in length, and purplish or violet cones, each

[1] As I will often have occasion to refer to the trees on the Churchill estate, in the County Armagh, Ireland, I may here take the opportunity of mentioning that the collection is unique in its way, comprising, as it does, unusually large specimens of many of the rarer and less known conifers. The various species of *Cephalotaxus*, *Torreya*, *Athrotaxis*, and the *Fitzroya*, all revel in the peaty soil and humid atmosphere of this part of Ireland; while many of the rarer species of *Pinus* and *Abies* have attained to unusual dimensions. Here the first cones of the true *A. magnifica* were produced; also those of *A. nobilis*, the latter being sold at a guinea each.

about 2½ inches long, by fully 1 inch in diameter, the bracts varying much, both in shape and length. The rate of growth is slow in this country, although instances have been recorded in which fully 1 foot has annually been added to the height for nearly fifty years; and a specimen in Haddingtonshire, when swept away by the great flood in the Tyne, in 1891, was nearly 70 feet high, and contained fully 140 feet of timber. It succeeds best in damp, rich soils, and when the atmosphere is comparatively still, and charged with moisture. The well-known Canada balsam is the resin which exudes from the bark of this tree.

**A. balsamea hudsonica** is a dwarf and sterile form found at high elevations, but is of no particular interest as an ornamental shrub.

**A. brachyphylla,** Maximowicz. Short-leaved Japanese Fir. (*Synonyms:—Pinus brachyphylla*, Parlatore; *Picea brachyphylla*, Gordon; *Abies Veitchii* and *Picea Veitchii*, Hort; *Abies homolepis*, Lindley.) Saghalien and Japan. 1870.—This is well worthy of attention, being of free growth, highly ornamental, and perfectly hardy. It is handsome in habit, having regular whorls of somewhat rigid, horizontally placed branches, with densely arranged small leaves that are deep green above and intensely silvery beneath. The purplish cones are cylindrical, 3½ inches long by 1¼ inches wide, and smooth, by reason of the non-protruding scale bracts. The stem grows stout and straight, and when the tree is planted in light, dampish soil and a sheltered site, the upward rate of growth is from 18 inches to 24 inches per year. There cannot be a doubt that in the present species we have a highly ornamental tree and one that will yet turn out of value for forest planting, and every year it seems to improve and become a greater favourite with lovers of hardy conifers. The largest tree I have seen is growing at Claremont, in Surrey. It was planted by H.R.H. Princess Beatrice, on 7th April, 1883, and is now considerably over 25 feet in height, the branches covering a spread of fully 18 feet in diameter.

**A. bracteata,** Nuttall. Bristle Cone Fir. (*Synonyms:—*

*Pinus venusta*, Douglas; *P. bracteata*, Don; *Picea bracteata*, Loudon; *Abies venusta*, Sargent.) California. 1853.—Too much can hardly be said in favour of this comparatively rare tree, for, with its long and thick deep green leaves, somewhat erect habit and pleasant contour, it is beyond doubt one of the handsomest of the many conifers with which California has enriched our empire. Even the cones are so distinct from those of any other species that recognition of the tree by these alone is by no means difficult. In this country the lower branches of the tree have a somewhat decumbent habit of growth, while those farther up are horizontal or ascending. The leaves are of a distinct and beautiful dark green colour, and average about 2 inches in length, while the cones are 3 inches long, with the bracts developed into 2-inch long, leaf-like, linear spines. The largest, best furnished, and healthiest specimens that I have seen are growing in soil that is largely composed of peat, or to which a quantity of rich sandy loam was added at time of planting. After becoming established, the upward rate of growth is fairly rapid, the annual addition to the height of the specimens referred to for five consecutive years averaging 13½ inches.

**A. cephalonica,**[1] Loudon. Mount Enos Fir. (*Synonyms:—A. Apollinis*, Link; *A. panachaica*, Heldreich; *A. reginæ, Amaliæ*, Heldreich; *Pinus Abies cephalonica*, Parlatore; *Picea cephalonica*, Loudon.) Cephalonia. 1824.—This handsome fir is well adapted for general use in our country, and whether planted singly on the lawn, for which its well-furnished stem and wide spread of branches render it peculiarly suitable, or mixed with other trees in the woodland, it is at all times a pleasing object, and well worthy the attention of planters. Unfortunately, in certain soils, and when planted in unsuitable situations, young trees are apt to suffer from late spring frosts. This, however, should be no drawback to its extended use, as by a proper selection of soil and site, success in the cultivation of this tree is by no means difficult, and

[1] For a full account of this tree, with measurements of the original specimens at Blairadam, in Scotland, raised from seed sent home by General Napier, in 1824, see my article in *The Garden*, vol. xxviii., 1885.

already specimens from 70 feet to 80 feet high are plentiful in various parts of the country. As a forest tree this species is also likely to attract attention, its behaviour when subjected to close order of growth being highly commendable, and which, coupled with its rapidity of growth and value of timber produced, show that it may be used as a forest tree with at least fair prospects of a profitable result. A stiffish soil, such as a good clayey loam, and a northern or western aspect, will be found most suitable for this species, as these considerably retard early growth, the great evil to which the tree is susceptible in our clime. As an ornamental conifer this tree is of considerable importance, the long and lithe branches being well clothed with dark, olive-green foliage, while the whole contour is remarkably distinct and pleasing. Usually the lower branches have a wide spread in proportion to the height of the trunk, and are retained in a perfectly healthy condition when the tree is growing in the open. They are thickly covered with stiff, dagger-shaped leaves, each an inch in length, that terminate in sharply-pointed prickles. The cylindrical cones are from 5 inches to 6 inches long, about 1½ inches in diameter, and with the bracts exceeding the scales in length. Resin exudes freely from the surface of the cones when these are arriving at maturity. Timber of home-grown trees, which I have used experimentally for several purposes, appears to be of good quality, and very durable, and the results tend to prove that when of mature age the wood will be of value for outdoor purposes. It is very resinous and firmly packed.

Under favourable conditions the rate of growth of the tree is about 10 inches per year, three specimens of fifty years growth which I measured were, on an average, 38 feet high each, thus showing an annual increase in height of 9 inches since they were planted.

A hybrid between this species and *A. Pinsapo* has been raised by Mons. H. Vilmorin. It resembles *A. cephalonica* more than *A. Pinsapo* in habit and general appearance, while the cones showing distinctly the points of the bracts

are likewise more in keeping with those of that species. Though otherwise an interesting cross, the hybrid boasts no striking distinction as an ornamental tree.

**A. Cilicica,** Carrière. (*Synonym:—Pinus cilicica*, Parlatore.) Cilician Taurus.—Though not generally hardy in this country, yet the appearance of specimens that I have seen in widely different localities, causes the tree to be included here. It is much after the style of the common silver fir, but both branches and foliage are more slender and usually less plentifully produced. The leaves vary in length, according to their position on the branches, being shortest above, and largest and usually curved on the under sides. Not generally to be recommended.

**A. concolor,** Lindley and Gordon. Colorado White Fir. (*Synonyms:—Pinus concolor*, Parlatore; *Picea concolor* Murray; *P. lasiocarpa*, of gardens.) Colorado, Utah, and Arizona. 1851.—Although much confusion has existed between this and other allied species, yet the present conifer is easily distinguished by the irregular leaf arrangement, and by the upper and under sides of these being nearly the same colour —hence the specific name *concolor*, of similar or like colour. The leaves vary according to position from 2 to 2½ inches in length, are of a greyish-white hue, changing as they grow old to a soft, pale green. The cones, which are usually produced singly, are about 4 inches long, and the seeds larger and weightier than those of the nearly allied *A. grandis*.

As an ornamental tree, the present species must be considered as a decided acquisition, the general outline being symmetrical, but without the accompanying stiffness which so readily distinguishes several members of this family. The spread of branches in young and healthy trees being wide in proportion to the height, warns intending planters that sufficient space should be given for perfect development. In fairly exposed situations it would seem to thrive best, and, considering that on low-lying ground it has suffered from frost in spring, the elevated positions are to be recommended.

**A. concolor violacea.**—The dense bluish-green glau-

cescence with which the leaves of this variety are covered renders it one of the most distinct and pleasing of ornamental conifers. It is quite hardy, free of growth, and deserves to be widely known and appreciated.

**A. firma,** Siebold and Zuccarini. (*Synonyms:—Pinus firma,* Antoine; *Abies holophylla,* Maximowicz; *A. bifida,* Siebold and Zuccarini; *A. homolepis,* Siebold and Zuccarini.) Japan. 1861.—For the great variability of its foliage this tree is remarkable, and to which fact may be attributed the list of synonyms with which it is encumbered. The somewhat stiff, deep, glossy green foliage and partially erect habit of growth, as seen in the few specimens that are to be found in this country, renders the tree of some value for ornamental planting. The leaves range from under to considerably over an inch in length, some being flat and given off at right angles to the shoot, while others are short and up-curved. The cones are cylindrical, about 5 inches long, with imbricated scales and upward-pointing bracts, which terminate in sharp angular points.

It seems to be grateful for shelter from cold draughts of wind, and evidently thrives best in light, rich loam. In the younger stages of growth the leaves are oft distinctly cleft at the tips, hence the name *bifida,* but with age this gradually gives way.

**A. Fraseri,** Lindley. (*Synonyms:—Picea Fraseri,* Loudon; *Pinus Fraseri,* Parlatore.) Mountains of Carolina and Pennsylvania. 1811.—This tree has little to recommend it, whether for ornament or utility, when planted in these islands. It bears considerable resemblance to *A. balsamea,* and is in consequence often confounded with that species; but, in the absence of fruit, which is a speedy method of recognition, the structure of the leaves will always determine the difference. The more slender and upright growth, and smaller dark green, thickly-arranged leaves, are also differences that might be well pointed out in connection with the present species and *A. balsamea.* The cones are oval in shape, with conspicuous reflexed bracts. This is the tree which caused the mountains

on which it is found to be designated the Black Mountains, giving, as it does, the sombre hue for which they are justly remarkable. In this country the tree succeeds well on peaty soils, especially where a small quantity of loam has been added previous to planting. Rarely, however, is it a satisfactory species unless in the juvenile state.

**A. grandis,** Lindley. Tall Silver Fir. (*Synonyms:*—*Pinus grandis*, Douglas; *Picea grandis*, Loudon.) Vancouver's Island to California, near the coast; western slopes of Rocky Mountains. 1831.—This is a truly handsome conifer, and one that is well adapted for ornamental planting, the soft rich green foliage, densely branched stem, and symmetrical habit, being recommendations that are rarely so well combined in one species. The branches of *A. grandis* are usually arranged in flat, horizontal tiers, with the tips slightly upturned, and are, more particularly the branchlets, glabrous, and of a light, pleasing green. The leaves are of unequal length, arranged on the lower branches in double, and those near the top in treble, rows, the lower series of leaves being longer than the upper, or from 1½ inches to fully 2 inches in length. They are usually bifid at the ends, but this I have noticed is more particularly the case in the foliage of the branches near the top of the tree, channelled above, and with two silvery lines beneath. The cones are bronzy-green, 4 inches long by 1½ inches in diameter, almost cylindrical, usually in pairs,[1] and seated close to the stem, or, in other words, devoid of foot-stalks. The cone bracts are entirely hidden by the overlapping scales. The bark is smooth, and of a dull green when young, but becomes dark grey and rough when the tree has advanced in age, and filled with receptacles of clear, highly fragrant resin. The timber produced in this country is of excellent quality, being weighty, resinous, and the concentric rings firmly packed. The largest specimen which I have had cut down was, exclusive of the

[1] This is, however, not always the case, as I have noticed the cones in clusters of from five to seven in number. An excellent drawing of a cluster of five cones, from specimens sent by me from Penrhyn Castle to the editor of the *Gardener's Chronicle*, will be found in the *Linnean Societies' Journal*, vol. xxii.

broken top, 72 feet in height, measured 26 inches in diameter at the butt end, and contained 73 feet of timber.

On measuring some of the annual rings near the bark, I found them to average fully 1 inch in thickness, which speaks highly of the tree as a rapid timber producer. When felled and stripped of its branches, the balsamic fragrance, from the quantity of resin the tree contained, was perceptible for a considerable distance—further than I have ever noticed even with the Douglas fir—and the circumstance was commented upon amongst the woodmen employed in removing it.

The average upward rate of growth of *A. grandis* in this country is 17 inches, while the quantity of timber produced in fifty years by the large specimen just referred to gave an annual average of nearly 1½ cube feet. When cut into boarding, the wood resembled in appearance that of the common silver fir, but was perhaps darker, of greater specific gravity, and of firmer texture.

It works well, and takes a good polish ; but from the rapid rate of growth, the graining is rough, though perfect in delineation. When compared with foreign timber from British Columbia at the Colonial and Indian Exhibition, that produced in this country revealed but small differences, and nothing more than might be expected between that of a partially developed and a mature tree. Taking into consideration the quantity and quality of wood produced by *A. grandis*, as also its highly ornamental appearance and undoubted hardihood, it must be placed in the first rank for extensive planting in this country. It grows well on poor soils, the largest specimens in this country having been planted in rather light gravelly loam. For a full illustrated account of the tree, see my article in *The Garden*, vol. xxviii., 1885.

**A. lasiocarpa,** Hooker. (*Synonyms :—A.* (*Picea*) *bifolia*, Murray; *A. subalpina*, Engelmann.) Alaska, British Columbia, Oregon to Colorado.—This tree bears some resemblance to the better known *A. balsamea*, but it is of larger growth, with thin, whitish, smooth bark, which becomes cracked and ashy grey with the advance of years. Leaves

notched on sterile, and pointed on fertile branches, in many rows, and with two glaucous bands on the under sides. The cones are from 2 inches to $3\frac{1}{2}$ inches long, by 1 inch to $1\frac{1}{4}$ inches diameter, with the scales rounded or almost square, and the bracts remarkably short and quite concealed from view. This species does very well when planted in cool, rather moist soil; indeed, the finest specimens I have seen are growing in loamy peat. Great diversity of opinion has existed as to the specific limits of *A. lasiocarpa*, *A. Lowiana*, and *A. concolor*. After careful and lengthened observations of living specimens cultivated in this country, I have come to the conclusion that for garden purposes, at least the extreme forms of each should receive specific identity.

**A. Lowiana,** Murray. (*Synonyms:—Picea Lowiana*, Gordon; *Abies lasiocarpa*, hort.; *A. Parsonsiana*, hort.; *A. concolor*, Veitch; *A. concolor lasiocarpa*, Beissner; *A. grandis Lowiana*, Masters.) Western slopes of the Sierra Nevadas, North California, Oregon. 1851.—A handsome and, in this country, fast growing species, that is readily distinguished by its light and airy appearance, as well as comparatively long leaves, these frequently reaching 3 inches in length. They are generally of a pale glaucous tint, and so thinly arranged as to expose the shoots. The cones are oblong-cylindrical, and from 3 inches to 5 inches long, with crescent-shaped scales and minute bracts. Undoubtedly this is one of the most beautiful of the Californian firs, and when seen under favourable conditions in this country, with its long and peculiarly incurved foliage, which is silvery-green beneath, and regularity of branch arrangement, combined with its wonderful vigour and perfect hardihood, it may well rank with the choicest of ornamental conifers.

**A. magnifica,** Murray. Stately Silver Fir. (*Synonyms:—A. campylocarpa*, Murray; *Picea magnifica*, Gordon.) North California. 1851.—Though rather stiff of growth, yet when seen under the most favourable conditions, this is truly a beautiful and magnificent tree. The branches are horizontally arranged, with dense foliage, crowded more above than

below, each leaf being about 1¾ inches long, glaucous olive-green above, and marked with two silvery lines on the under side. The cones are cylindrical, 5 to 7 inches long, by from 2 to 3 inches in diameter, the scale edges incurved, and the protruding bracts terminating in a tail-like appendage. In its younger stages, the whole tree wears a whitish silvery appearance, as if coated with hoar frost; but this beautiful colouring is most noticeable when the specimens are growing under unusually favourable conditions. As an ornamental tree, the present species is of great value, while the growth is rapid, one specimen of which I kept a record having attained to the height of 25 feet in a little over twelve years. It thrives vigorously in reclaimed peat-bog; but it also does well in rich loam, as is evident from the growth of the tree at Woburn Abbey.[1]

**A. Mariesii,** Masters. Mountains of Japan. 1879.—This is likely to turn out a useful conifer for ornamental planting. It is remarkable in that the foliage resembles some of the Tsugas, while the large purple cones, often 5 inches long and cylindrical in shape, decide it to be a true Abies. The leaves are only ¾ of an inch long, many being much shorter, for the most part erect, and evenly disposed around the stem, and of a dull green colour. Being quite hardy in this country, it is to be hoped that it will soon get widely disseminated, while it grows with a fair amount of freedom, and in soils of ordinary quality.

**A. nobilis,** Lindley. Noble Silver Fir. (*Synonyms*:—*Pinus nobilis*, Douglas; *Picea nobilis*, Loudon.) Oregon and California. 1831.—This tree is one of the hardiest and handsomest of the group, and is probably more common than any other of the recently introduced species. Amongst the silver firs it is certainly the most conspicuous and beautiful, the

[1] The once famous collection of coniferous trees in Woburn Park, and from which specimens for the compilation of *The Pinetum Woburense* were mainly obtained, is now almost a thing of the past. Many of the finest trees have either been killed outright, or are sadly crippled and disfigured by the encroachment of stronger growing species. At one or two points in the evergreens, but particularly in the flower garden, are still a few rare and beautiful specimens.

deep silvery glaucous foliage, regularly and neatly disposed branches, and not too stiff outline, being points of special interest and recommendation. The leaves are crowded on the upper sides of the branches, varying in length from 1 to $1\frac{1}{4}$ inches, rigid, obtusely pointed, and with two glaucous bands beneath. The cones are very handsome and conspicuous, being often 6 inches long, perfectly cylindrical, obtuse at both ends, and with conspicuously recurved bracts. Few trees are less particular about the quality of soil in which they are planted than that in question, but it certainly prefers that of not too light nor too dry description. It grows rapidly, the average annual increase in height of several specimens that I measured being 20 inches for a period of twenty-five years. The production of wood is likewise rapid, as will be learnt from the following :—A tree of this kind was planted in good loamy soil and a moderately sheltered situation in 1854, it at that time being a robust growing specimen of 3 feet in height. In 1884, or thirty years afterwards, it had attained to a height of 55 feet, when it was found to contain 61 cube feet of wood, this giving an average annual increase of fully 2 feet per year. The quality of home-grown timber is not such as to be recommended, it being soft, easily worked, and clean of graining, and from this I do not consider that the tree will be of any special value for afforesting purposes.

**A. nobilis glauca.**—Though not of constant character as regards foliage colouring, yet, in certain specimens the glaucous tint is so well pronounced and distinct as to merit the attention it has received. It is equally robust with the species.

**A. Nordmanniana,** Spach. Nordmann's Silver Fir. (*Synonym :—Picea Nordmanniana*, Loudon.) Crimea, Caucasus. 1848.—This must be considered as one of the finest and most valuable of the European or Asiatic species of silver fir. As a park and lawn tree, it can scarcely be surpassed, the regular and handsome outline, rich glossy green foliage, and stately habit, rendering it a decided acquisition for ornamental

planting. The branches are rigid and horizontal, the deep glossy green leaves about an inch long, and the cones ovoid and nearly 6 inches long. The timber produced in this country is, judging from many specimens that I have had the opportunity of examining, of excellent quality, being hard, close-grained, and lasting. The tree succeeds well in every part of the country, and has an advantage over the common silver fir that, owing to starting into growth later in spring, it is less apt to be injured by unseasonable frosts. Few trees, too, are less particular as to soil, it succeeding well in reclaimed peat bog, stiff loam, decomposed vegetable matter, and that of a chalky or limestone formation. In warm, sandy, or gravelly soils, it is apt to suffer from the attacks of a species of Aphis. As a forest tree, it is certainly well worthy of attention.[1]

**A. numidica,** De Lannoy. (*Synonym:—A. Pinsapo baborensis*, Cosson.) Algerian Mountains. 1861.—As yet, this species is by no means common in the British Isles, but from its undoubted hardihood and pleasing green foliage is sure to receive attention. It is of neat, rather pyramidal habit, with sub-erect branches, and short, crowded leaves, each about 1 inch long, and rich deep green above, with two faintly-marked silvery lines beneath. Being of free and bold growth, succeeding well even in poor gravelly soils, where many of its fellows refuse to grow, and perfectly hardy, this tree is to be recommended for general use throughout Britain. In order to show off the neat habit of growth, an open though not too exposed site is to be recommended.

**A. pectinata,** De Candolle. Common Silver Fir. (*Synonyms:—Abies alba*, Miller; *A. vulgaris*, Poiret; *A. Picea*, Lindley; *A. excelsa*, Salisbury; *A. taxifolia*, Desfontaines; *Picea pectinata*, Loudon; *Pinus pectinata*, Lamarck; *Pinus Abies*, Duroi; *Pinus Picea*, Linnæus.) Central and Southern Europe. Sixteenth century.—As an ornamental tree this is only of secondary importance; but for the great

[1] A monograph on Nordmann's silver fir, by the present writer, will be found in the "Transactions of the Royal Scottish Arboricultural Society," vol. ix., 1879.

quantity of fairly valuable timber produced, it is well worthy of attention, although its merits in this particular have been rather overrated. Both branches and branchlets stand out horizontally, the deep green leaves, which are two-rowed on the juvenile, but pectinate on the adult specimens, are marked by two distinct silvery white lines beneath. They vary on the same twig from $\frac{3}{4}$ to fully $1\frac{1}{2}$ inches in length. The cones are cylindrical, usually about 6 inches long by fully $1\frac{1}{4}$ inches in diameter. The timber is of fair quality, and well adapted for rough outdoor carpentry. It is elastic, somewhat irregular in graining, soft, apt to shrink, and decays speedily on exposure. For temporary buildings, tool-sheds, and cattle shelters of a rather temporary nature, it is to be recommended. In connection with sluices and dams, it is an excellent timber, while for lining the banks of streams and rivers, to prevent the sides being washed away, I have found it to be peculiarly suitable. The tree itself will grow well beneath the shade and drip of others, produces a large quantity of timber, and is not over-exacting as to the quality of soil in which it is planted.

**A. pectinata fastigiata.** The Upright Silver Fir.—This is a very distinct form, the branches of which have a decided upright inclination, with the branchlets, particularly the tips, falling backwards. It varies a good deal, however, and specimens quite unworthy of the name, though departing considerably from the normal form, are in cultivation. In the best fastigiate variety, the leaves differ considerably from the species, being smaller, more slender, and slightly up-curved.

**A. Pinsapo,** Boissier. Spanish Silver Fir. (*Synonym:*—*Picea Pinsapo*, Loudon.) Southern Spain. 1839.—The short and prickly foliage, extreme density and rigidity, combined with compact growth and a unique appearance, at once distinguish this from all other silver firs. When favourably situated, few trees are more ornamental and effective; but to see it in its beauty it must be planted singly, or sufficiently ar apart from others so that the branches may have room for

full development. It is most attractive during late spring or early summer, for then the young growths make a striking contrast with the older foliage, the whole forming a regular and compact cone of the finest colour. There is also a stately and dignified air about this tree that one cannot help admiring, and which is further enhanced by the regularly whorled branches, as well as the brightly-tinted rigid leaves, which are short, sharp, and thickly arranged all round and at right angles to the stem, and numerous beautiful purplish-green, ovate-cylindrical cones, which stand well out and are often fully 5 inches long. The latter constitute a striking feature of the tree. In so far as the economic value of the timber is concerned, it might be pointed out that on comparison with that of the silver fir, it is harder, closer grained, and better suited for the finer constructive works.

Under favourable conditions, the rate of growth annually of *A. Pinsapo* for fully twenty years was about 14 inches, while in one case, at least, I have known it to produce 30 feet of timber in a like number of years. For planting on chalky ground, this tree is certainly an acquisition, and at High Elms,[1] Sir John Lubbock's Kentish property, where are some of the largest and healthiest trees of its kind in the country, I have oft been struck by its rapid rate of growth, and that, too, where only a small quantity of loam overlies the chalk. It is perfectly hardy, and succeeds well when planted on exposed ground.

**A. Pinsapo Hamondii,** of which there is a fine specimen near Hemel Hempstead, in Herts, is a curious form, giving one the idea of having been beheaded, and the branches, in consequence, much lengthened and supple. It forms a dense mass of foliage, of the same colour as the parent, but the leaves are individually smaller. As a lawn bush when planted on the green sward, it is both interesting and beautiful.

**A. Pinsapo variegata.**—From the yellowish-green

[1] At High Elms several species of Abies and other coniferous trees have attained to noble dimensions. Sir John Lubbock tells me that the choice of trees, selection of sites and planting, were carried out under the supervision of Loudon.

tint of the branch tips, this variety is somewhat interesting, but it can hardly be considered an acquisition.

**A. religiosa,** Schlechtendal. (*Synonyms:—Picea religiosa*, Murray; *Abies hirtella*, Lindley.) Mountains of Mexico and Guatemala. 1838.—This species has not proved generally hardy, though in Ireland and Southern England, particularly near the sea, fair specimens are to be occasionally met with. It is a tall tree with dark glossy green leaves, each about 1½ inches long, and pretty deep-blue cones, about 5 inches in length, and half that in diameter, and with the whitish bracts more or less protruding, the acuminate points being reflexed. Specimens over 70 feet high may be seen in the south of Ireland.

**A. sachalinensis,** Masters. Saghalien Fir. (*Synonym:—A. Veitchii sachalinensis*, Schmidt.) Sachalin, Jesso. 1879.—From what little is known of this species it would seem to be an undoubted acquisition, and though nearly allied to the better known *A. Veitchii*, yet the foliage has a certain resemblance to that of *A. sibirica*. The small blunt-pointed leaves are crowded spirally around the stem, and are about 1 inch in length; while the cones are 3 inches long by 1 inch in diameter, with projecting and reflexed bracts. It has proved quite hardy in this country.

**A. sibirica,** Ledebour. (*Synonyms: A. Pichta*, Forbes; *Picea Pichta*, Loudon.) Northern and Eastern Russia.—This cannot be called a desirable tree for planting in these isles, it usually wearing a shabby, starved appearance, being thin of foliage and the branch tips cut back and arrested by cold winds and frost. The leaves are dark green above and silvery beneath; but the whole aspect of the tree greatly reminds one of a stunted specimen of the common silver fir. The best specimens in this country are growing in stiff, dampish, clayey loam, on the northern side of a sharply rising hill.

**A. Veitchii,** Lindley. (*Synonyms:—Picea Veitchii; Pinus selenolepis*, Parlatore; *Abies nephrolepis*, Maximowicz.) Mountains of Japan. 1879.—This is a tree of neat and spiral

growth, and is so far the most rapid grower of the Japanese species. In several ways it is a very desirable conifer, the small grass-green foliage, with two silvery lines on the under sides, and well-branched trunk, rendering it very distinct and pleasing. The tree is usually slender in outline, the branches short and irregularly disposed, and the leaves, some of which are bifid at the tips, fully three-fourths of an inch long. The cones, which have been produced in this country, are about 3 inches in length, oval-shaped, and with the acuminate bracts projecting beyond and bent downwards over the scales. It has been found perfectly hardy in several parts of the country, and is truly an Alpine species of rare beauty, and that is yet destined to an exalted place in our parks and woods. Specimens planted under favourable conditions have attained to a height of 10 feet in ten years, the branch spread being fully as much as the height.

**A. Webbiana,** Lindley. Webb's Silver Fir. (*Synonyms:—Picea Webbiana*, Loudon; *Abies chiloensis* of gardens.) Eastern Himalayas. 1822.—This is one of the handsomest denizens of the Himalayan forests; but, unfortunately, it is not well suited for the climate of this country, being what is usually termed "spring tender." By careful choice of soil and situation, many fine specimens have, however, been reared, principally in seaside parts of the country, and these have amply rewarded the trouble taken to suit their particular wants by their stately grandeur and distinct appearance. The leaves are deep glossy green above, with two broad and very conspicuous silvery bands beneath, very variable in size and arrangement, usually bifid, and about 2 inches long. The cones before becoming ripe, and when they have attained to full size, are highly ornamental, and remarkably weighty, from the great quantity of resin they contain. They are about 7 inches long, of a deep purple colour, and generally several occur on the same branch; indeed, what with their number and weight, I have more than once seen large branches broken from off the trees. So strikingly different in general appearance is this tree that no mistake can ever occur in confusing it with any other

species. Where it does well, the growth is long and stout, but too frequently the tips of the branches are bitten by frost in early spring, and when this has occurred several times the tree wears a by no means pleasing appearance. Usually the tree does well and escapes frost-bite when planted in cold and stiffish soil and facing north or east; but the finest specimen I have seen, and from which these notes were compiled, was growing in damp alluvial deposit and within sea influence.[1] It had attained to a height of 58 feet in thirty-two years, and contained fully 37 feet of timber. On several occasions I have examined home-grown timber of the tree in question, but it was soft, and did not last long when used out of doors.

**A. Webbiana Pindrow.** (*Synonyms:—Picea Pindrow*, Royle; *Pinus Pindrow*, Royle; *Picea Pindrow*, Loudon.) Eastern Himalayas.—This cannot be included as a perfectly hardy tree, for even in warm situations by the sea coast it not unfrequently wears anything but a robust and healthy appearance. The stem is tall and straight, with short, spreading branches, and leaves that are very variable both in size and arrangement. In adult trees the leaves are arranged in two rows, and are from 2¼ to 2½ inches long, while on young specimens they are thickly and regularly disposed on all the branches, and about 1 inch long. They are usually bifid, blackish-green above, and with two greyish-white lines beneath. Cones usually oval, 4½ inches long by 2½ inches diameter, and for the greater part produced singly on the three top tiers of branches. They are, when of full size, of a deep purple colour, and highly ornamental to the tree.

The leading shoot, which is frequently 1¼ inches in diameter, readily yields to finger pressure, and is welted or thickly covered with longitudinally arranged raised surfaces like whipcord. The buds are remarkably large and prominent,

[1] Both this species and the variety have attained to large dimensions at Penrhyn Castle, North Wales. The collection of coniferous trees in the park at Penrhyn is particularly rich, including large specimens of *Cunninghamia sinensis*, *Cephalotaxus pedunculata fastigiata*, as well as many of the rarer species of *Abies*, *Picea*, and *Pinus*.

oval in form, resinous and scaly. In the younger stages of growth this tree presents an unusually stiff, sturdy, and unyielding habit of growth. By careful choice of soil and site, the latter in particular, spring tenderness may to a great extent be obviated, the conditions being that a northern or eastern aspect be chosen, also a cool, late soil and fairly sheltered situation. A full account of this variety, with illustrations, by myself, will be found in *The Garden*, vol. xxx., 1886.

## ARAUCARIA (Jussieu).

*Flowers* usually dicœcious.[1]

*Cones* large, globular, or ovoid; females cylindrical.

*Scales* spiral, deciduous, united with the bracts.

*Seeds*, one to each scale, inverted, and more or less attached to the scales.

*Leaves* spirally arranged, closely imbricated, and widest at the base.

The Araucaria differs from the true pines and firs in having the sexes usually on different trees, in the cone scales being one-seeded, and the seed more or less attached to the scales.

**Araucaria imbricata,** Pavon. Chili Pine. Southern Chili. 1796.—Though of somewhat stiff outline, there is something remarkably pleasing and distinct about a well-grown and well-furnished specimen of this Araucaria. Unfortunately, however, the opinion entertained regarding the value of the tree for general planting in this country years ago does not hold good to-day, and a great change in its culture has in consequence been brought about. In the younger stages of growth, the Araucaria is no doubt one of the most distinct of all coniferous trees, but with the advances of age, it usually begins to show signs of decay, the lower branches

[1] The Araucaria is not always dicœcious as stated by some writers. At Cudham Hall, in Kent, the property of the Earl of Derby, I have seen large numbers of both male and female cones produced on the same tree.

dying off one by one, when the whole tree presents a very unsightly appearance. The branches are somewhat drooping, with upturned tips, the ovate lanceolate leaves stiff, leathery, and sharply pointed, each about 1 inch long, by half that in width, and bright green in colour. Seed-bearing cones spherical, or nearly so, and 7 inches in diameter, while the thickly arranged, bract-like appendages, each an inch long and standing erect, impart to these a curious hedgehog-like appearance. The male cones are cylindrical, fully 3 inches long, by half that in diameter, and usually produced in quantity. They frequently remain wholly or in part intact for several years.

## ATHROTAXIS (Don).

*Flowers* monœcious, occasionally dicœcious, solitary; males in terminal spikes.

*Cones* globular, with the scales spirally arranged.

*Seeds*, from three to six under each scale, free, pendulous, and winged.

*Leaves* spiral, without petioles, scale formed.

Evergreen trees of small growth, natives of Tasmania, and remarkable for the jointed appearance of the shoots.

**Athrotaxis cupressoides,** Don. Tasmania.—When seen growing under favourable conditions, this is a neat and very distinct small-growing conifer, with thick and spirally arranged coriaceous leaves, which are of an intense glossy green colour. It delights in a cool and quiet situation; and the finest specimens I have seen were growing on a dampish mossy bank in a forest break. It is a species that is well worthy of culture, and should be included in every selection of coniferous plants.

**A. laxifolia,** Hooker. (*Synonyms:—Athrotaxis Doniana*, hort.) Tasmania.—To a great extent this resembles the latter species, but the foliage is less thickly arranged, or not so closely appressed, longer and pointed, and the tree is of

slower growth, this being particularly noticeable when the plants are growing side by side, and under exactly similar conditions. The cones are terminal sub-globose, ¾ of an inch in diameter, and composed of about sixteen spirally arranged scales, and roundish, deeply winged seeds. This is a neat little tree, of slow growth, and remarkable for the bright and cheery tint of the foliage. It has attained to a height of 15 feet in Southern England.

**A. selaginoides,** Don. Tasmania. (About 1847).—This is the hardiest, best known, and most accommodating of the species. From the others it may readily be distinguished by its twiggy growth, flat, scale-like leaves, which are closely appressed to the branches, and grass-green colour. The cones are globular, and about ¾ of an inch in diameter. This species does remarkably well in peat-bog, and the largest specimen I have seen was growing in the open portion of a larch wood, and amongst loamy peat, rather damp, and where sunshine rarely gained admission. Growing under favourable conditions, this specimen attained to a height of 12 feet in fifteen years.

## CEDRUS (Loudon).

### THE CEDARS.

*Flowers* monœcious, stamens in catkins.

*Cones* oval, flattened at the ends, erect, smooth, on the upper sides of the branches.

*Scales* overlapping, closely placed, rounded on the outer margin.

*Seeds* in twos under each scale, furnished with a persistent membranaceous wing.

*Cotyledons* leafy, mostly nine in number.

*Leaves* scattered, or tufted, needle-shaped, stiff, and persistent.

Large growing evergreen trees, with the leaves either arranged singly on long shoots or in bundles on short spurs.

**Cedrus atlantica,** Manetti. (*Synonyms:—Abies atlantica*, Lindley and Gordon; *Pinus cedrus atlantica*, Parlatore; *Cedrus africana*, Gordon.) Algeria. 1841.—In a young state particularly this is hardly recognisable from the better known *C. Libani*, although after a few years' growth its erect habit and rigid branches are sufficient means of identification. As an ornamental tree, it cannot compare with the Lebanon cedar, although as a forest tree it may be preferable, producing more valuable timber, and having less inclination to ramify into stout and unwieldy branches. For the latter reason alone it is valuable, for while the branches of the Lebanon cedar suffer much from wind and snow, those of *C. atlantica* remain unharmed, their less length and weight, as also upward inclination, freeing them from injury.

In exposed situations, and where the soil is naturally stiff, the Mount Atlas cedar makes a sturdy growth, and for this reason it is now much sought after for planting on bleak and exposed park grounds. Little is yet known regarding the value of the timber as produced in this country, too short time having elapsed since the introduction of the tree for this to have approached maturity. That it is superior to wood of the Lebanon cedar in trees of equal age I am, however, convinced, and there can be little doubt that in years to come, when maturity has been nearly attained, it will be found of some value for constructive purposes. Generally throughout this country it does well, and specimens fully 70 feet high are now to be seen. Rarely if ever does the African cedar throw weight into the branches, it being far more inclined to rush up straight, and expend its energy in the building up of a clean and well-balanced stem. The branches, too, are short and lithe in comparison with those of the Lebanon tree, and well covered with shorter and more spiny foliage. The cones are ovate and depressed at the ends, nearly 3 inches long, and when ripe are of a chocolate-brown colour. It grows more rapidly than the Lebanon, and is destitute of the flat or table-headed appearance that is so characteristic a feature of that tree. Owing to its having a small branch spread in propor-

tion to the height, it is also more valuable as a forest tree than that species, grows on poorer and more exposed land, and is an excellent seaside tree.

The general points of recognition of the Mount Atlas cedar are the comparatively short and less flat branch arrangement, the thick, short, and prickly leaves, and erect leading shoot, while the branch tips are straight and stiff.

**C. atlantica glauca.**—This is one of the most distinct and ornamental of hardy conifers; indeed, it is a gem that arrests the attention of everyone. Little or no difference, except in foliage tint, is discernible between the glaucous African cedar and the typical or parent plant as usually seen, for the same rigid and irregular mode of growth is noticeable in both species and variety. The foliage colouring is, however, both distinct and remarkable, the deep grass or blue-green of the normal tree giving place to a most enticing silvery hue in the glaucous variety, and which renders it as distinct and pretty a conifer as could well be desired. The branches are sturdy and stiff pointed, of various lengths at the same height, and rounded rather than flat. Two of the largest specimens I have seen are growing on the estate of High Elms, Sir John Lubbock's property. These trees are as stately as they are beautiful, being nearly 50 feet in height each, and regularly clothed with foliage, which at a short distance away has more the appearance of burnished silver than anything else I can recall to mind. Cones have been produced, and these, when fully developed, but before becoming ripe, are of an intense bluish-green colour.

**C. Deodara,** Loudon. Indian Cedar. (*Synonyms:*—*Pinus Deodara*, Roxburgh; *Abies Deodara*, Lindley; *Larix Deodara*, Koch; *Cedrus Indica*, Chambr; *C. Libani Deodara*, Hooker.) Himalayas. 1831.—This tree stands almost unrivalled in the grandeur of its lithe and beautifully pendulous branches; indeed, it is open to question whether a more distinct and graceful hardy conifer has yet found its way into this country. Few trees are more accommodating as to soil than the present species, but it is not well adapted for cold

and exposed sites. In a young state the Indian cedar is rendered highly ornamental by reason of the decidedly pendulous leader and gracefully drooping branch-tips, abundantly supplied with glaucous green foliage of the richest and most delicate description. The male or pollen cones, which are from 2 to 3 inches long and standing erect, are produced in such quantity that they are quite a feature of the tree; while the seed-bearing cones are cylindrical, 3 to 4 inches long, and depressed at both ends. They are usually produced on the upper sides of the stout top branches. The rate of growth is rapid, 70 feet in height having been attained by specimens in England in fifty years. Timber produced in this country is fine grained, but soft, and not at all durable.

**C. Deodara crassifolia** is altogether a less ornamental tree than the species, the thick short branches being pendulous at the tips to only a very small extent. The leaves are short and stout when compared with those of the parent.

**C. Deodara robusta.**—In the best forms of this variety the growth is stout and long, and the foliage more distinctly silvery than in the species. There seems, however, to be many worthless forms in cultivation under the name.

**C. Deodara viridis** has the foliage of a rich and deep green, more resembling that of *C. atlantica*, and seems quite constant in character.

**C. Libani,** Loudon. Lebanon Cedar. (*Synonyms:*—*Pinus Cedrus*, Linnæus; *Larix Cedrus*, Miller; *Abies Cedrus*, Poiret; *Larix patula*, Salisbury; *Cedrus patula*, Koch.) Syrian Mountains, Cyprus. About 1666.—With its massive and well clothed trunk, far-spreading and flatly pendulous branches, and deep glaucous green foliage, this is beyond doubt one of the grandest and most majestic as well as distinct and easily recognised of all trees. When wanted as a purely ornamental specimen, the Lebanon cedar must have plenty of room for perfect development of root and branch, as when crowded with other trees in the forest the appearance is miserable, from the dying back of the branches and branch tips. The branches are usually arranged horizont-

ally, and are quite flat, generally in distinct tiers, but sometimes scattered irregularly over the trunk, and long in proportion to the height of the tree; while the foliage is deep grass green, thickly set, each leaf 1 inch long, and sharply pointed.

Cones are abundantly produced, each being 4 inches long by about half that in diameter. The timber, though not much in demand in this country, is excellent in quality, and stands the changes from damp to drought in rather a commendable manner. This, however, is dwelt on at length in the chapter devoted to the timbers of coniferous trees.

**C. Libani argentea** is certainly a distinct and desirable variety, with foliage of silvery whiteness; but several specimens that I have examined under this name should really be assigned to the glaucous form of the Mount Atlas cedar.

**C. Libani brevifolia** has shorter leaves than the species, but in my opinion it is a decidedly inferior tree in point of ornament.

**C. Libani decidua** is one of the most interesting and remarkable of the many varieties of the tree. Though the whole of the foliage is not shed at the same time, still, sufficient is to warrant the use of the name deciduous, and some curious errors have been made by supposing the tree to be dying off, or in a bad state of health. The largest specimen I have seen is growing on Lord Derby's property in Kent, and where for many years I have noticed the late autumn shedding of the foliage, curiously bare appearance of the tree in winter, and shooting forth of the young leaves in spring. Further than the annual casting of the leaves, I could detect no difference between the species and variety either in the male or female cones, or in the length or colour of foliage; generally, however, the leaves are shorter, and the cones sparsely produced, when compared with the ordinary run of Lebanon cedars. The specimen referred to was in perfect health, and about 65 feet high.

**C. Libani nana.**—This is of very dwarf growth, specimens upwards of twenty years old being only 4 feet in height,

and about the same in branch spread, obtusely cone-shaped, and abundantly supplied with dark green foliage. The flattened, horizontally arranged branches readily reconcile it with the species, the only difference being that these are so thickly produced one above the other that the hand cannot be passed between any two, this giving the plant a dense, somewhat stiff appearance, that is further augmented by the almost uniform length of the branches. There is no perceptible difference in the foliage from that of the species; perhaps generally the leaves are shorter, and decidedly sharper, and average between $\frac{3}{4}$ of an inch and 1 inch in length.

This must be considered as a real dwarf form, and as it is of neat growth, and with foliage of a pleasing dark bluish-green tint, its propagation and dissemination is more to be desired than is that of many so-called pigmy conifers.

Growing in grounds near Hemel Hempstead, in Herts, are good examples of this dwarf and interesting cedar.

**C. Libani pendula.**—Considering how very distinct and beautiful this variety is, one can only wonder that it is not more common. The branches are gracefully pendent, and the drooping tips hang over each other in the easiest possible manner. A fine old tree, bearing cones in abundance, may be seen in the village of Dulwich.

## CEPHALOTAXUS (Siebold et Zuccarini).

*Flowers* dicœcious, in globular heads.

*Fruit* several, drupaceous.

*Seed* solitary, almond-like, with no true aril, enclosed in the fleshy cup.

*Leaves* linear, alternate, in two rows.

Evergreen trees or shrubs, with the leaves arranged alternately in two rows. Natives of China or Japan.

**Cephalotaxus drupacea,** Siebold et Zuccarini. Plum-fruited Cephalotaxus. Japan.—This is here seen as a

low shrub, of rather irregular growth, with flattened, horizontally arranged branches, and short, stiff branchlets. The leaves, which are arranged in two opposite rows on the upper sides of the branches, are, particularly towards the branch tips, upturned, or so nearly erect that they form a triangular-shaped trough. Towards the branch extremities the leaves are 1¼ inches long, about half that nearer the stem, distinctly keeled, and of a deep green above, and with two broad silvery bands on the under side. For nearly the entire length they are ⅛ of an inch wide, and abruptly pointed. The damson-like fruit, produced usually in threes on the under sides of the branches, are ovoid in shape, but much narrowed at the base, about 1¼ inches long, by ¾ of an inch in greatest diameter, and placed on short, stout footstalks. Each berry contains a solitary, hard-shelled, nut-like seed, about ¾ of an inch long, enclosing an almond-like kernel. The smell emitted by the fruit when bruised is highly offensive, resembling that of dubbin. Although quite hardy in most parts of the country, yet the finest specimens I have seen were in Southern England and Ireland. The situation should not be draughty, or too exposed, and the soil about equal parts of loam and peat or leaf soil. As an ornamental species, the present shrub is well worthy of culture, the by no means stiff habit of growth and plentifully produced deep green leaves, often greenish-yellow at the tips, with the curious purplish, plum-like fruit, rendering well-grown specimens both distinct and interesting.

**C. Fortunei,** W. Hooker. Fortune's Cephalotaxus. North China. 1849.—For general planting this would seem to be a more desirable species than the latter; at least it succeeds at a greater number of stations in this country. The comparatively long and slender branches are horizontally arranged, and rather sparsely supplied with long, acute-pointed leaves, that are bright and glossy green above and silvery beneath. They are about 3 inches long, almost fleshy, and arranged in two opposite rows. The fruit is elliptic in shape, tapering to both ends, 1¼ inches long by ¾ of an inch in greatest diameter, and produced usually singly, but occasionally in twos and threes.

In light, peaty soil, where shelter is provided, it forms a neat ornamental and highly interesting specimen, and is worthy of greatly extended culture.

**C. pedunculata,** Siebold et Zuccarini. (*Synonym:—Taxus Harringtonia*, Knight.) Japan. 1837.—This is a distinct and free-growing species of small and rather spreading growth, the branches being for the greater part whorled, and the branches flattened and horizontal. Leaves about 2 inches long and $\frac{1}{4}$ of an inch wide, distichously arranged, bright green on the upper, and with two distinct glaucous lines on the under sides.

The fruit is oval in shape, and usually three in a cluster, each being $1\frac{1}{8}$ inches long, by fully $\frac{3}{4}$ of an inch in greatest diameter, and produced on a footstalk about $\frac{3}{4}$ of an inch in length.

**C. pedunculata fastigiata.**[1]—This distinct and well-marked variety resembles in growth the upright yew, the branches being perfectly erect and the foliage somewhat spirally arranged. Usually, however, some of the branches, particularly those near the ground, have the horizontal growth of the species, while upwards they are strictly fastigiate. The largest specimen in this country is at Penrhyn Castle, and which I had transplanted from the home nursery to a favourable site some years ago. In this specimen the peculiarity of growth is particularly noticeable, for at 3 feet and 5 feet from the ground several branches are growing in a perfectly horizontal manner, or almost at right angles to the main stem, while both above and below these the branches are strictly fastigiate. The leaves on the horizontal branches are distichously arranged, or in two opposite rows, while those on other parts of the tree are irregularly scattered, or nearly spiral by their closeness along the shoots. As this Cephalotaxus is little known, the following description of the distinguishing characteristics may be useful:—In habit and foliage it nearly approaches the Irish yew, but the branches

[1] For a full account of this interesting shrub, see article by the present writer in *The Garden*, vol. xxx., 1886.

are rarely so erect and adpressed, nor the leaves of such a deep green as in those of that tree, while it rarely rises to more than 8 feet in height. The leaves are bluntly falcata, or more usually sabre-shaped, less than 2 inches long, by $\frac{1}{8}$ of an inch broad, thick and fleshy, and for the greater part furnished with short footstalks. Above they are of a deep glossy green, with a distinctly raised narrow midrib, while beneath two rather indistinct silvery bands run along their full length. Both branches and branchlets have a peculiar channelled or tuberculated appearance, caused by the long decurrent base of the leaves, these, in most instances, reaching $\frac{1}{2}$ an inch in length, and are persistent after the removal of the foliage.

**C. pedunculata sphæralis,** Masters.—This differs principally in the fruit being almost circular or spherical in shape, instead of oval as in the species. They are produced freely on a goodly-sized specimen growing on the Churchill estate, North Ireland, far more freely than is the case with the species alongside which it is planted. The fruit is clustered, sometimes upwards of a dozen together, each berry being fully $\frac{3}{4}$ of an inch in diameter, and containing an oval-shaped seed. The habit is more open than that of the species, and the foliage usually shorter. From Wiston Park, Steyning, I have received fruiting specimens of this variety.

## CRYPTOMERIA (Don).

### THE JAPAN CEDARS.

*Flowers* monœcious; males in axillary spikes; females solitary, spherical and terminal.

*Cones* globular, prickly when ripe.

*Scales* palmately divided at the edge, wedge-shaped and loose.

*Seeds* four or five under each scale, with a slight membranous wing.

*Cotyledons* flat, leafy, from two to four, but mostly in threes.

*Leaves* linear, alternate (often heteromorphic), sickle-shaped, usually in five rows.

Large growing evergreen trees, natives of China or Japan. In some of the varieties the primordial leaves are retained for an indefinite period of time.

**Cryptomeria japonica,**[1] Don. (*Synonyms:—Cupressus japonica*, Linnæus; *Taxodium japonicum*, Brongn; *Cryptomeria Fortunei*, Koch). Shanghai. 1845.—Delighting and thriving most luxuriantly in cool, damp soils, the humid atmosphere of the British Isles is peculiarly suitable for the successful culture of this handsome and hardy conifer. Cold, draughty, and exposed situations it, however, cannot bear; so that in planting this fact should be borne in mind, while at the same time few coniferous trees can surpass the present species for thriving where the soil is stiff or cold and in a sunless situation. When seen under favourable conditions, the Japan cedar is a tall, portly tree, of somewhat broadly conical shape, with a clean, straight stem, horizontally spreading branches, often slightly drooping with upcurved tips, the lateral ones divided into numerous frondose branchlets, thickly covered with dark bluish-green foliage. The rigid leaves are fully $\frac{1}{2}$ an inch long, incurved or awl-shaped, slightly quadrangular, appressed to the stem, and indistinctly marked with two glaucous lines underneath. Both male and female cones are abundantly produced, the latter being almost globular, about $\frac{3}{4}$ of an inch in diameter, usually singly and erect, with the scales serrated at the edges, so that the fully developed cone is rough and prickly. Quite a feature of the tree are the male catkins, which grow thickly in axillary spikes in the leaf axils, usually towards the branch extremities. A peculiarity of the cones is that in some instances the axes elongate and produce foliage leaves at their apices, thus imitating in a marked degree those of *Cunninghamia sinensis* and several species of Picea. When favourably

[1] For a full description of *Cryptomeria japonica*, see article by myself in *The Journal of Forestry*, vol. xi., 1886.

situated, the rate of growth is rapid, one specimen that I measured having reached the height of 74 feet in forty-two years. Home-grown timber of this tree is very light in proportion to the bulk, and bears a marked resemblance to that produced in its native country. It is white, or rather inclined to yellowish-white, soft, easily indented, and pleasantly perfumed.

**C. japonica araucarioides.**—This is a small growing and neat habited shrub with short, regularly arranged leaves, and slender almost undivided branches. The foliage being thickly arranged, causes the plant to have a dense, massive character, while the colour in healthy specimens is a dark bluish-green. From dried specimens of *C. japonica Lycopodioides* (Carriere) that have been sent me, I am inclined to believe that the two varieties are identical.

**C. japonica elegans.**—This differs greatly both in habit and appearance from the species, and produces cones very sparsely, these, however, being indistinguishable from those of the species. It is, unquestionably, one of the most desirable and beautiful of hardy conifers, the remarkable change in colour from the bright green of the warm season to the bronzy-crimson of the winter and early spring months, combined with the elegant outline and perfect hardihood, placing this variety in the front rank of useful and ornamental trees of medium proportions. It stands exposure better than the species, and like that tree, will grow on cold, stiff soils where only a limited number of conifers could subsist. In a young state it is apt to form several leading shoots, and sometimes ungainly side branches, which should be removed by timely and well-directed pruning. The cones are $\frac{5}{8}$ of an inch long; and the leaves, in which the primordial shape is retained for an indefinite period, rather longer than the cones, flattish, velvety in texture, and abundantly produced.

**C. japonica elegans nana.**—This should not be confused with the dwarf form of the species, which is also known under the varietal name of *nana*, the present plant retaining its coppery tint during the winter and early spring

months. It is of small growth, thickly branched and foliaged, the branchlets being shortly pendulous.

**C. japonica Lobbi.** — Compared with the species, this forms a tree of narrower and more compact outline, the leaves also being of a brighter and more vivid green colour. It is equally vigorous with the species, and in this country has attained to stately dimensions, with a straight, well-formed trunk, that is furnished throughout with bushy, thickly foliaged branches, the spread of which is usually less than one-third of the height.

**C, Japonica Sandersii,** which originated in Cork, is of dense habit, with very distinct foliage.

**C. japonica spiralis.**—Though quite distinct and noteworthy, this cannot be described as an ornamental variety. The branches are lithe and weak, irregular as to length and arrangement, and having short, closely-appressed leaves of a dull green colour, and so thickly and shortly set as to appear in a spiral manner throughout the entire length.

## CUNNINGHAMIA (Brown).

*Flowers* monœcious.

*Cones* globular or ovoid; sometimes with the axis elongated into a leafy shoot.

*Scales* without bracts, acute-pointed.

*Seeds*, three under each scale, winged, pendulous.

*Leaves* lanceolate, flat.

*Cotyledons*, two.

A medium sized evergreen tree from China, nearly allied to Araucaria.

**Cunninghamia sinensis,**[1] Brown. (*Synonyms:*— *Belis jaculifolia*, Salisbury; *Pinus lanceolata*, Lambert.) Southern China. 1804.—This tree is of too tender constitution for the climate of Britain generally, still in certain favoured localities, particularly within the influence of the sea, it does

[1] For a full account of *Cunninghamia sinensis*, see my article in *The Garden*, vol. xxix., page 173, 1886.

very well, and forms a handsome specimen, which, for distinct appearance and beauty of foliage, has few equals amongst coniferous trees. In no other conifer with which I am acquainted is there so diverse an appearance of foliage, the pleasant pale green of the younger foliage affording a striking contrast to the deep, almost yew-green of the older leaves.

As an ornamental tree of very unusual appearance, the Cunninghamia should find a well-chosen spot in every collection, for although somewhat tender in unfavourable districts, yet in many places it has stood perfectly unharmed through our most severe winters, when other so-called hardy conifers were badly injured by the frost. The branches are horizontally arranged, rather tortuous, and covered with smooth, dark brown bark, as in a young Sequoia.

The leaves are various in colour, the oldest being brownish-green, while those produced during the past five years are of all shades, from dark green to the lightest and freshest of pea-green, with two distinct silvery lines above, and two rather indistinct lighter coloured bands on each side of the prominent midrib beneath. They are lance-shaped, $1\frac{1}{2}$ inches long and slightly serrated on the edges. The cones are terminal, sub-erect, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, and usually borne singly, and about three on each branchlet. They are formed of about thirty-six imbricated, persistent scales, with three seeds beneath each, the whole cone thus containing about one hundred seeds. A peculiarity of the cones of this tree, and which, Sir Joseph Hooker tells me, sometimes occurs in spruces, is that after being fully formed, the axis continues to elongate, and produces leaves which are in no way different from the ordinary foliage. Stranger still, but this has not been noticed in any other conifer, the elongated portion throws out buds and produces twigs in the usual manner, the cone gradually disappearing when, after the third year, no trace of it can be detected, and the branch has elongated to 6 or perhaps 8 inches. This conifer throws up suckers from the base of the stem. The finest specimen I have seen, and from which these notes were compiled, is growing in the

flower garden at Penrhyn Castle, North Wales, and has attained to the noble height of nearly 50 feet. At Claremont, in Surrey, I have also seen a well-developed specimen. The timber is clean, firm, and of a desirable mahogany colour, and polishes nicely.[1] Sandy loam, with a free admixture of decayed vegetable matter, suits the Cunninghamia well.

## CUPRESSUS (Linnæus)

(*Including Retinispora and Chamæcyparis*).

### THE CYPRESSES.

*Flowers* monœcious; males spiked, cylindrical; females rounded.

*Cones* woody, globular, or oblong, and with numerous seeds to each scale. They vary from ¼ to nearly 2 inches in diameter.

*Scales* peltate, from six to ten, terminating in a more or less curved point.

*Seeds* numerous, winged, inserted on the upper interior surface of the scales.

*Cotyledons* leafy, mostly in twos.

*Leaves* scale-like, closely imbricated, never in two ranks, but generally four-rowed.

*Branches* irregularly arranged along the stem.

*Buds* not scaly.

After a careful and lengthened study of the genera *Retinispora* and *Chamæcyparis*, under almost every phase of cultivation in this country, I have here included both under *Cupressus*, the general habit, foliage, and fruit clearly pointing out that they have no claim to separate generic positions, and are more nearly allied to this than any other genus.

[1] At the Surveyors' Institution, London, a large slab of home-grown timber of the Cunninghamia, which I sent there in 1895, shows well the quality and graining of the wood.

**Cupressus arizonica,** Greene. Arizona Cypress. California, Arizona, New Mexico. 1891.—This recently introduced conifer is of bushy, compact habit, with wide-spreading branches, and closely imbricated foliage. The cones are nearly spherical, with a small umbo to each scale. The handsome form and colour and the neat disposition of its foliage will gain for this species many admirers once it becomes better known. It has been referred to *C. Benthami*, a tree of very uncertain identification.

**C. funebris,** Endlicher. (*Synonyms :— C. pendula*, Staunton ; *C. amœna*, Karl Koch.) China, Sikkim. 1846.—This is unfortunately a conifer that cannot be depended on in point of hardihood for indiscriminate planting in any but the more favoured and maritime parts of the British Isles. It is remarkable in presenting striking changes in its aspect during the various stages of growth, and at the same time needle-like leaves resembling those of some forms of the so-called Retinispora, and scale-like, closely appressed foliage may be found on the same tree. When young it is usually of compact and upward growth, but with advancing years it becomes gradually gracefully drooping. On young trees the leaves are distant, linear, and decidedly glaucous, whereas in older specimens they are oval, and closely imbricated usually in four rows, or both forms may occur at the older stages. The cones are spherical and half an inch in diameter.

**C. Goveniana,** Gordon. (*Synonyms :—C. californica*, Carrière ; *C. cornuta.*) California. 1846.—When seen in a flourishing condition, which, however, is rarely the case in this country, this is a pretty and interesting conifer, and particularly during the early spring months when laden with pollen catkins. It usually presents a bushy and dense habit of growth, with upright spreading branches, and is somewhat after the style of a dwarfed globose specimen of the better known *C. macrocarpa.* The fragrant leaves are small, scale-like, and bright green, closely arranged, broad at the base, and pointed. Cones prettily tinted, dark brownish, streaked with lighter colour, and furnished with four horn-like projections at

the scale tips, each about $\frac{1}{2}$ an inch in length. The plant, distributed under the name of *C. cornuta*, is identical with the present species. Rarely does *C. Goveniana* attain to a greater height than 20 feet, although a specimen growing in the pleasure grounds at Churchill, in the North of Ireland, is nearer 30 feet high.

**C. Goveniana glauca** appears to be rare in cultivation, but for ornamental purposes it is even superior to the parent. It has a hoary and glossy blue tinge of foliage, not unlike what we are accustomed to see in the best form of *Juniperus Sabina tamariscifolia.*

**C. Lawsoniana,** Murray. Lawson's Cypress. (*Synonyms:—Chamæcyparis Lawsoniana*, Sargent; *C. Boursieri*, Carrière.) North California (Shasta), Oregon. 1854.—A thoroughly hardy, free-growing, and beautiful tree, and one that combines the useful with the ornamental in a high degree. It has been planted largely in every part of the British Isles, and in soils and situations that are widely different, yet it is rare to find a diseased or unhealthy specimen.

As an ornamental tree it is, perhaps, superfluous to say one word in favour of this cypress, its qualities in this particular being well known and justly appreciated. We may, however, refer to its cheerful and desirable shade of green, and to the gracefully recurved and feathery-like foliage, neither of which is surpassed by any other conifer. It is of columnar habit, but not formal in outline, as it is relieved by the drooping spray and elastic leading shoot, the latter being just sufficiently tilted to one side to impart a pleasing finish to the tree. The branchlets are slender and flattened, the decurrent leaves arranged thickly in alternate opposite pairs, while the usually solitary roundly-compressed cones are about the size of peas, each composed of seven scales and about nineteen seeds. The male catkins are bright red, and very conspicuous. The timber is of a pleasing yellow colour, remarkably close of grain, and takes a nice smooth polish. It has been used for panelling and furniture with good results, but out of doors it has not proved so lasting. The rate of growth

is somewhat rapid, several specimens of which I have kept a record having attained the height of 43 feet in twenty-seven years. It may be of interest to state that I have seen self-sown plants of the Lawson cypress along the margins of woodlands in Northern Ireland.

**C. Lawsoniana alba spica** is not a very desirable variety, though perhaps less unhealthy in appearance than other patchy variegated conifers. The whitish branch tips turn almost the normal green with the advent of winter.

**C. Lawsoniana Alumi** is of strict growth, with distinct and very pleasing bluish-green foliage. It is a neat and interesting variety, and worthy of culture where ground space is confined.

**C. Lawsoniana argentea** is of moderately compact growth, and rarely rises to a great height. The foliage is extremely pleasing, being of a decided silvery-grey tint, and constant in character.

**C. Lawsoniana Bowleri** is a close and compact growing mass of semi-pendulous deep green branches and foliage.

**C. Lawsoniana compacta** is of dwarf growth, and forms a closely habited shrub, with ascending branches and a good supply of foliage.

**C. Lawsoniana cœrulescens** is a dwarf, bushy variety, growing about 3 feet high, and with numerous and much divided branches plentifully supplied with bluish-green foliage, faintly marked on the upper sides with silvery-grey bands. It is a decidedly worthy variety, and should have a chosen spot in the ornamental grounds.

**C. Lawsoniana elegantissima.**—This is perhaps the best variegated variety of the Lawson's cypress. It is of vigorous growth, of good habit, and with the bark and leaves of a delicate yellowish-green tint.

**C. Lawsoniana erecta viridis.**—This is one of the commonest varieties in cultivation, of tapering outline, and with the branchlets closely set on, and appressed to the stem. The foliage is of the brightest green the whole season through.

Excellent for planting in confined spaces, but too formal of growth for general planting.

**C. Lawsoniana filifera** is of easy spreading growth, but taller than broad, and remarkable for the long and slender branchlets, the tips of which are tassellated, and of a semi-pendulous character.

**C. Lawsoniana Fleetii.**—This is quite distinct, the growth being very stiff and erect, and the foliage of a pleasing bluish-grey glaucous hue.

**C. Lawsoniana Haskin's variety** is certainly one of great merit, the young shoots being of a delightful orange-yellow colour, and quite distinct from anything we have before us. It originated as a seedling at the Branksome Nursery, Bournemouth.

**C. Lawsoniana intertexta.**—This has no particular merit when compared with the species, the branch growth being very robust, while, owing to the branches being far apart, the plant has a rather untidy and open appearance. The partially drooping branch tips are a redeeming quality.

**C. Lawsoniana lutea** is of compact habit, the branch tips being golden yellow, but the variegation is inconstant, and varies much in depth of tint with the particular specimen.

**C. Lawsoniana nana** is only suited for rock work or ornamental gardening. It rarely exceeds 2 feet in height, and is of rounded and close-growing habit.

**C. Lawsoniana stricta,** as the name denotes, is another of the upright growing kinds, but it is of less tapering growth than most.

**C. Lindleii,** Klotsch. (*Synonyms:—C. thurifera*, Lindley; *C. Knightiana*, Gordon; *C. Coulteri*, Forbes; *C. Karwinskyana*, Regel; *C. lusitanica*, Lindley; *C. Uhdeana*, Gordon.) Mountains of Mexico. 1840.—If only for its graceful habit and conspicuous bluish-green foliage, this species is well worthy of attention. It is not a common plant, but is evidently the handsomest and hardiest of the Mexican cypresses. The growth is refined and pleasing, and the contour somewhat

pyramidal, while the bright bluish hue of the foliage contrasts strangely with the reddish-brown bark of the stem and branches, patches of which are every here and there visible from the fact of the branches being somewhat sparsely produced. The sub-division of the branches is remarkably regular, the branchlets for almost the entire length of the shoot being of nearly uniform length. The leaves are regularly appressed and scale-like, while the bright yellow catkins at the branch tips are highly ornamental, and often produced when the plants are four years old. When ripe, the cones are nut brown, the scales ending in a conical point. It makes a good pot plant. Specimens fully 40 feet high are to be found in Ireland.

**C. lusitanica,** Miller. The Cedar of Goa. (*Synonyms:—C. glauca,* Lamarck; *C. pendula,* L'Heritier; *C. Uhdeana,* Gordon.)—This is a beautiful species—indeed may well be described as one of the most distinct and graceful members of the family to which it belongs. The trunk is well clothed with somewhat pendulous branches, the foliage being scale-like and closely imbricated. Fruit is produced in great quantity, the individual cones being about the size of those of the Lawson Cypress, but with a distinct hooked appendage on the outer side of each scale.

Both fruit and leaves are covered with a beautiful glaucous bloom.

In maritime situations it succeeds best—and by far the finest trees I have seen are throughout Ireland generally.

**C. Macnabiana,** Murray. (*Synonyms:—C. glandulosa,* Hooker; *C. glauca,* Department of Agriculture, U.S.A.) California, Mount Shasta. 1852.—Although this is a very beautiful and distinct species, it has never found much favour with the British tree planter. This is certainly to be regretted, as the low compact habit of growth and deep bluish-green glaucescent foliage render it a very distinct and desirable species.

**C. macrocarpa,**[1] Hartweg. Monterey Cypress. (*Synonyms:—C. Lambertiana fastigiata, C. Hartwegi,*

[1] For a full account of *Cupressus macrocarpa,* illustrated, see my article in *The Garden,* vol. xxix., 1886.

Carrière.) Monterey, California. 1848.—There is something remarkably pleasing about this tree, especially when seen at its best, within the influence of the sea—the graceful spreading habit, plentiful supply of branches, which are well furnished with dark grass-green foliage, and stately form of growth, rendering it as unique as it is desirable.

The branches are very closely arranged, but heavy and massive, with an upward inclination, although the flat, cedar-of-Lebanon-like appearance characterises certain specimens, and are longest at about midway up the stem. It is readily distinguished from other species by the large size of the cones, these averaging 2 inches long, by fully 1 inch broad. They are of a light brown colour, and usually borne in clusters of three or four.

**C. macrocarpa fastigiata.**—This is a well-marked variety, in which the branches closely press on the main stem, the diameter of spread in a specimen 50 feet in height being only 16 feet. It is well, however, to remember that intermediate gradations between the spreading and pyramidal forms are by no means uncommon. The foliage in both trees is of the brightest green; and the long whip-like shoots, with the conspicuous reddish bark, impart a peculiar grace to healthy specimens.

As an adjunct to our somewhat limited list of seaside conifers, this cypress is of undoubted value, flourishing better in maritime than in midland parts of the country. It grows freely in the Orkney Islands. Home-grown timber is of excellent quality, being very beautifully grained, while it is of a deep yellow outwards and red towards the centre.

**C. macrocarpa Guadeloupensis.** Guadeloupe Cypress. (*Synonym:—Cupressus Guadeloupensis*, Watson.)—Judging from young specimens that I have seen, this will yet turn out to be a useful conifer for ornamental planting, should it be found hardy enough to withstand our insular climate. The branches are slender, and the foliage of an intense glaucous green colour, and which is a ready means of identification. The cones are much smaller than those of

the species, being only 1 inch in diameter, and almost circular, each scale being provided with a projecting umbo. It occurs in Guadeloupe Island, off the coast of Lower California.

**C. macrocarpa lutea,** raised by Messrs. Dickson at their Chester nursery, is an undoubted acquisition, and should it, when advanced in growth, retain the beautiful and distinct golden tint for which young specimens are justly remarkable, its use in ornamental planting will be hard to estimate. It is of compact and neat growth, but by no means formal, with a plentiful supply of finely divided and neatly arranged branches and branchlets; and this, with its warm golden tint of foliage, claims for it a foremost place in our list of variegated conifers. This variety has been awarded a first-class certificate by the Royal Horticultural Society.

**C. nootkatensis,** Lambert. Alaska Cypress. (*Synonyms :—C. nutkaensis,* Hooker; *Chamæcyparis nutkaensis,* Spach; *Thuyopsis borealis,* Carrière; *T. nidifica,* Rovelli.) Vancouver Island, Oregon, British Columbia. 1794.—This is a fine, spreading branched tree, with an exterior resemblance to *C. Lawsoniana,* but certainly inferior to that species in point of ornamental appearance. It is somewhat stiff and rigid in outline, the main branches having a partially upright tendency, with numerous drooping branchlets, thickly clothed with small, closely-imbricated, sharp-pointed leaves, of a rich dark green above, slightly glaucous beneath, and emitting a pungent odour when crushed. The cones are nearly spherical in shape, each $\frac{1}{2}$ an inch in diameter, composed of four scales, with, on an average, eleven seeds. The male catkins are sulphur yellow.

For economic planting, this cypress is well worthy of attention, it being of undoubted hardihood, and producing valuable timber, which is of a pale yellow colour, light in proportion to the bulk, and very durable. Trees of twenty years growth are, from a great number of measurements I have taken, usually about 19 feet high, rarely more, while the taper in the trunk is greater than in any other of the species.

**C. nootkatensis argentea variegata** differs only in having some of the branches spotted with, or wholly, creamy-white.

**C. nootkatensis compacta** is characterised by a dwarfer and more compact habit of growth than the type, and is valuable where space is limited, or for variety.

**C. nootkatensis lutea,** of which there is a large specimen at Penrhyn Castle, in Wales, is far more ornamental than the typical tree, the branch tips being of a light and pleasing yellow colour. In this variety, the branchlets, being pendulous, and hanging limp and easy for fully 1 foot in length, render the trees both distinct and desirable.

**C. nootkatensis pendula** is remarkable for the graceful pendulous foliage, which reminds one of that of the weeping-willow. It is a very distinct form from the Milford Nurseries, Godalming, but, so far as I know, is not yet generally cultivated.

**C. (Retinispora) obtusa,** Koch. (*Synonyms:—Chamæcyparis obtusa*, Siebold et Zuccarini; *Retinispora obtusa*, Siebold; *Thuya obtusa*, Masters.) Mountains of Japan.—Although of rather stiff habit, the outline being regularly conical, dense growth, and sombre hue, there is something remarkably pleasing and distinct about a well-grown specimen of this Japanese conifer. In this country the tree has attained, in some few instances, to nearly 30 feet in height, with crowded branches and flattened frond-like branchlets, well supplied with small scale-like light green leaves. The cones are quite round, about half an inch in diameter, and composed of from eight to ten scales, having an umbo on their outer surface.

**C. obtusa filicoides,** when seen in good form, is a desirable variety, in which the equally arranged fern-like branchlets, furnished with the brightest green foliage, which is of a silvery tint beneath, are points of special recognition. The leaves are imbricated in four rows, and the cones are rounded and fully one-fourth of an inch in diameter.

**C. obtusa filifera** is rendered distinct from every other variety by reason of the long, pendulous, thread-like

branchlets, which oft terminate by tufts of finely divided shoots. The leaves are subulate, distinct, and of a pleasing shade of green ; while the cones or strobiles are about the size and shape of a small pea. It is one of the most distinct and desirable of ornamental conifers.

**C. obtusa lycopodioides** is a well-known variety, with curiously flattened branch tips, and of rather loose and ungainly growth. It frequently fails to grow in a satisfactory manner.

**C. obtusa nana** is another dwarf-growing form, but in point of beauty is hardly comparable with the latter.

**C. obtusa pygmæa** is a useful miniature conifer for planting amongst dwarf-growing plants on the rock-work or in the shrubbery. Rarely is it found more than 15 inches in height, but the spread is wide proportionately, and flattish, while the foliage does not lose one bit of its rich green hue the whole season through. Of all the miniature conifers, this Selaginella-like variety is one of the prettiest and most interesting.

**C. (Retinispora) pisifera,** Koch. (*Synonyms:— Chamæcyparis pisifera*, Siebold et Zuccarini ; *Retinispora pisifera*, Siebold ; *Thuya pisifer*, Masters.) Mountains of Japan.—This is readily distinguished from the latter species by its more open habit of growth, and by its more slender and usually longer branches and feathery foliage. The branches are somewhat irregular of arrangement, though the outline of the tree is informly pyramidal, the leaves scale-like, four-rowed, and of a dark bright green, with two glaucous lines beneath. Fruit about the size of a pea, and borne in clusters of from two to ten.

**C. pisifera plumosa** is a distinct and well-known variety, with numerous sub-erect branches, well furnished with deep green, awl-shaped foliage. The feathery branchlets and rich colour render it a very desirable garden conifer.

**C. pisifera plumosa argentea** has silvery tinted foliage, and is highly ornamental.

**C. pisifera plumosa aurea** is even a more orna-

mental plant than the parent, with thickly-set branches, the greater portion of which is of a desirable golden-yellow colour. It is one of the best of the small growing ornamental conifers.

**C. pisifera squarrosa.**—This is of bush-like growth, thickly arranged both in branches and branchlets, and with needle-shaped, silvery-white foliage.

**C. pisifera squarrosa dubia** is a compact, little bush, but varies a good deal both in shape and density of branches. The colour of foliage nearly approaches the latter, but individually the leaves are stouter and longer. The cones of all these varieties are identical with those of *C. pisifera.*

**C. sempervirens,** Linnæus. (*Synonyms:—C. fastigiata,* D. C.; *C. pyramidalis, C. Whitleyana,* Carrière.) Levant, Himalaya. — This is of distinctly pyramidal growth, the branches usually heavy, and thickly beset with tiny branchlets, covered with smooth, imbricated, yellowish-green leaves. The cones are plentifully produced, and being of a light brown colour, contrast strangely with the heavy masses of foliage. Each cone is fully 1 inch in diameter, nearly round, and composed of convex angular scales, with a raised point in the centre of each. There is a noble clump of these trees at Penrhyn Castle, North Wales.

**C. sempervirens horizontalis** differs only from the species in the spreading branches and smaller cones, but it is by no means common in cultivation.

**C. thurifera,** Humboldt. Mexico.—This bears a great resemblance to the better known *Thuya orientalis,* but the branches are usually more pendent, and altogether it is a more desirable specimen for ornamental purposes. It requires a warm situation and rich soil; indeed, the largest specimen I have seen is growing on an estate in Ireland. Wherever it will grow this species is well worthy of culture, but it is not generally hardy. The specimens I have seen under the name of *C. thurifera* are quite distinct from any other species of my acquaintance.

**C. Thyoides,** Linnæus. (*Synonyms:—Chamæcyparis sphæroidea,* Spach; *Retinispora ericoides,* Gordon.) Eastern

States of North America. 1736.—At all stages of its growth, and when in the flush of health, this cypress is a tree of great beauty, the evenly spreading branches, rich glaucous foliage, and dense pyramidal outline, being its chief characteristics. The leaves are closely appressed, and the cones the same shape and size as peas.

It delights in a dampish, loamy peat, and it will even put on its best form in pure but partially reclaimed peat bog; indeed, by far the finest specimen I have seen was growing by the margin of a mixed pine and birch wood in Ireland in the latter class of soil.

**C. Thyoides Hoveii** is the most remarkable deviation from the species of any of the varieties. The branchlets are here and there of quite a tufted appearance, from the number and closeness of the slender terminal twigs. It is of no particular value.

**C. Thyoides leptoclada** is of low growth and strict habit, with foliage of two distinct kinds—scale-like, and awl-shaped—and bluish-grey of colour.

**C. Thyoides nana** is a dwarf and pretty form, with bright, shining green foliage, especially when planted on damp soils.

**C. Thyoides variegata** has some of the branch tips of a golden-yellow, but the amount of variegation differs considerably with the particular specimen.

**C. torulosa,** Don. (*Synonym :—C. Tournefortii,* Tenore.) Temperate Western Himalaya. 1824.—For planting where space is rather confined, few trees are better adapted than the one in question, the easy though columnar habit of growth, slender branchlets, and bright glaucous foliage being all desirable acquisitions. The branches, which are thickly produced, have a decided upward tendency, but are, nevertheless, not painfully so, as is the case with some conifers, for the tufted branchlets, with their easy arranged foliage, deprive it entirely of all stiffness and formality. The cones are globose, from 1 to 1½ inches long, produced in dense clusters, and composed of about ten scales with seventy seeds. In cutting up the

timber of a specimen that had attained to 43 feet in height, I found it hard, close-grained and fibrous, of a pleasing purplish-yellow colour, and very fragrant, the latter being distinctly recognisable even when the tree was being felled.

**C. torulosa Corneyana** is of dwarf and more spreading growth than the species, and with the branches more lithe and slender.

## DACRYDIUM (Solander).

*Flowers* diœcious.

*Fruit* erect and fleshy.

*Seed* with a hard shell investing the kernel, and partially surrounded by an outer cup-shaped aril.

*Leaves* variable scale-like, or needle-shaped.

These are evergreen trees, with variable foliage. Only one species has been found sufficiently hardy for outdoor culture in this country.

**Dacrydium Franklinii,** Hooker. The Huon Pine. South and west shores of Tasmania.—Though usually branded with the title of "half-hardy," and fought shy of by cultivators in consequence, yet this is by no means generally the case, for healthy and well-furnished specimens may be met with in many counties from Edinburgh southwards—specimens that have stood unscathed through the most severe winters we have experienced for many years back. As seen in this country, the Huon pine is usually of pyramidal contour, the branch spread being very restricted when compared with the height. The trunk is erect and straight, the branches shooting off horizontally from the stem, and the crowded branchlets, slender, pendulous, and cypress-like, and imparting an elegant weeping habit of growth to the tree. The foliage is of a bright grass-green, almost pea-green, the leaves being small, scale-like, and closely packed together. The male catkins are solitary at the branch tips, and the fruit is small and fleshy. Soil would not seem to be a very important factor in the cultivation

of the tree, but situation must be attended to. Preferable, perhaps, is soil of a peaty loam or rich alluvial deposit, the latter particularly if a certain proportion of sand is present. Situation is evidently of far more importance, and this should always be sheltered and free from cold draughts, else the tree soon assumes a wretched and meagre appearance. It has attained to nearly 50 feet in height in various parts of Great Britain. The timber produced in its native country is highly valued, and good examples of it may be seen in the museum at Kew.

## FITZROYA (J. D. Hooker).

*Flowers* dicœcious.

*Cones* solitary, terminal, globose or star-shaped, and consisting of nine scales.

*Scales* in whorls of three, the intermediate three only being fertile.

*Seeds* winged, three under each fertile scale.

*Leaves* usually three-ranked, flat, stalkless, and loosely imbricated.

An evergreen tree or shrub found on the Patagonian Mountains. In this country it rarely exceeds 18 feet in height.

**Fitzroya patagonica,**[1] Hooker. Mountains of Western Patagonia, Chili, Valdivia. 1849.—Though this tree thrives well in certain places and becomes a decidedly ornamental conifer, yet it is not to be recommended for general planting unless in the more favoured and warmer parts of the country. When seen, however, under favourable conditions, it is both distinct and ornamental, the deep green of the long, whip-cord-like branchlets, which are usually arranged in irregular semi-drooping masses, rendering fair-sized specimens different in appearance to almost every other conifer. It forms no permanent leader, but rather several aspiring shoots, the greater portion of

[1] For a full account of *Fitzroya patagonica*, as cultivated in this country, see my article in *The Garden*, vol. xxix., 1886.

which is tilted over gracefully, and with the drooping side shoots form the chief characteristic of the species. The leaves are whorled, usually in fours, deep grass-green above, and with a silvery glaucous tint beneath. The cones produced in this country are small globose bodies, consisting of about three rows of whorled scales. The largest specimen I have seen is growing in a sheltered site on a quickly-sloping bank on the Churchill estate, County Armagh, Ireland; but there are many fine examples in this country from Gordon Castle, Banffshire, southwards. The soil in which the Irish tree is growing is loamy peat, and plenty of quickly passing away moisture is always provided. This specimen, with its long whip-cord-like branch tips, is decidedly ornamental, and makes one wish that the species was more commonly planted.

## GINKGO (Linnæus).

*Flowers* dicœcious; males in umbellate pendulous spikes; females in terminal clusters or long pedicels.

*Fruit* drupaceous, and enclosed at the base in a fleshy cup.

*Seeds* erect, ovoid, and covered with a hard, bony shell.

*Leaves* deciduous, stalked, fan-shaped, and covered with radiating nerves.

*Cotyledons* two.

A handsome, large-growing, deciduous tree, with fan-shaped leaves that are either tufted on short spurs or scattered on the longer growths.

**Ginkgo biloba,** Linnæus. Maidenhair Tree. (*Synonym*: —*Salisburia adiantifolia,* Smith.) Northern China. 1754.— There are many beautiful specimens of this tree in almost every part of the British Isles, thus showing its general adaptability for the climate of this country. The glossy green, fan-shaped leaves, cut up like some of the species of Adiantum, impart to this noble tree a distinct and remarkable

appearance; indeed, in the light and open aspect, peculiarly shaped deciduous foliage, and stately dimensions, we have in the Ginkgo one of the most distinct and pleasing of hardy trees. The tree is of rather spiry growth, with smooth fan-shaped, yellowish-green leaves, both sides being of the same colour, and marked by parallel lines. Fruit about the size of a walnut, enclosing a marble-sized kernel.

**G. biloba aurea** is decidedly an acquisition, the already yellowish-green leaves wearing in this variety a beautiful sunny golden colour. It does not grow so quickly as the species.

**G. biloba macrophylla** differs in the much larger foliage, which is deeply divided into three or five lobes, these again being sub-divided, and often dentated on the margins.

## JUNIPERUS (Linnæus).

### THE JUNIPERS.

*Flowers* diœcious, but frequently monœcious; males in spikes; females short, axillary, and bracteated at the base.

*Fruit* a globular cone or berry, composed of from three to six fleshy scales.

*Seeds* erect, from one to four, mostly three in each fruit.

*Leaves* opposite or ternate, scale-like, the primary ones pointed.

*Cotyledons* two.

These are evergreen trees or shrubs, and may be readily recognised by the berry-like fruit, which, when ripe, is for the most part deep purple, black, or reddish-brown, and wingless seeds. Both foliage and fruit when crushed emit a pleasant resinous odour.

**Juniperus bermudiana,** Linnæus. Bermudas.—In this country the situations are few where the present juniper can be said to succeed, and for this reason it is rarely met with in cultivation. In the north of Ireland, and in southern and

western England it succeeds fairly well, and on the sandy soil of Surrey I have seen a well-furnished and healthy specimen. It is thickly branched, and of tapering outline, with scale-like, imbricated leaves on the adult tree, those on the young plant being needle-like, and each about ½ an inch long. The berries, which are usually produced singly at the branch tips, are smaller than those of our native species. The wood is readily worked, highly fragrant, and, when more plentiful than it is at present, was largely used in the manufacture of lead pencils. A free and light soil, and shadyish situation suit it best.

**J. californica,** Carrière. (*Synonyms:—J. tetragona, osteosperma,* Torrey; *J. tetragona,* Cooper; *J. occidentalis,* Gordon.) Utah, Arizona, California. 1839.—According to soil and situation, this species varies considerably, sometimes occurring as a far-spreading, bush-like specimen, while at others it ascends to nearly 30 feet in height. The foliage, too, at different stages of growth varies greatly, the leaves on the younger plants being usually sharp-pointed, and arranged in threes, whereas in after years they are short, blunt, and imbricated. It grows best in sandy soil. In the absence of fruit it is difficult to distinguish the present species from the better known and more generally cultivated *J. occidentalis.* The berries of the latter are not unlike those of our native species, while in *J. californica* they are larger, the berry being dry and containing only one seed, the stony coating of which is harder than that of any other species of my acquaintance. It is of tree-like growth, with thickly-arranged branches and silvery-greyish leaves, but it has no special recommendation for ornamental planting. The growth, even under the most favourable conditions, is remarkably slow.

**J. californica utahensis** is of low-spreading growth, with stout short branchlets, and an easy and pleasing habit. It has not generally succeeded under cultivation in this country.

**J. chinensis,** Linnæus. (*Synonyms:—J. japonica,* Carrière; *J. flagelliformis* and *J. Reevesiana,* hort.) Himalaya, China, Japan. 1804.—This is probably the most beauti-

ful and accommodating of the several species of juniper. There are two forms—male and female—though occasionally I have seen both sexes present on one and the same specimen. The male or pollen-bearing plant is by far the most ornamental, and especially so during the spring months when laden with the conspicuous golden flowers. The habit is strictly erect, especially in the upper half, the foliage acicular, and of a pleasing bright green tint, though occasionally the leaves are scale-like and imbricated, particularly towards the top of the specimen. The conspicuous orange-yellow male flowers are in many cases so thickly produced that the branches are weighed down in consequence. In the female plant the habit is far more spreading than with the latter, the leaves are for the greater part scale-like and overlapping, and the berries small and purplish-violet in colour.

**J. chinensis albo-variegata** has many of the branchlets of a light cream or almost white colour, the green portions also appearing of a brighter tint than that of the species. It is of dwarf-spreading growth.

**J. chinensis aurea** is surpassed by no other conifer of this class as a bright, golden-foliaged shrub. It is of free, upright growth, with a plentiful supply of branches and foliage, and stands full exposure in a commendable way.

**J. chinensis** (Japanese form.) (*Synonym :—J. japonica*, Hort.)—This is a dwarf-spreading form of dense growth, with either acicular or scale-like foliage. On the adult plant the leaves are for the greater part ovate, blunt, and closely imbricated ; while on the juvenile specimen they are generally straight, stiff, and tapering to a sharp point. The berries are sparsely produced, and usually singly at the branch tips; they being oval in shape, small, and of a glaucous purple colour. In Japan this form is most commonly to be met with. The dimorphous foliage, and size, composition and arrangement of fruit, have caused me to place this as a variety of *J. chinensis*.

**J. chinensis aurea** (Japanese form) is somewhat in the way of a dwarf plant of the golden Chinese variety, but the

colour is not so deep nor so long sustained as in that well-known form.

**J. chinensis aurea variegata** (Japanese form) differs from the preceding in having only a few of the branch tips suffused with a golden-yellow colour.

**J. communis,** Linnæus. Common Juniper. Greater part of the Northern and Eastern Hemisphere, Britain.—Whether as regards height, shape, or arrangement, and colouring of foliage, this must be described as a very variable species. Altitude and elevation have no doubt much to do with this marked dissimilarity in appearance, but certainly not all, for even on our low-lying commons and downs the variety afforded by these wild junipers is something remarkable. In height we find them of all sizes, up to as much as 24 feet, some tall, straight and tapering gradually throughout, others with rounded tops and nearly equal diameter from base to tip, while others again assume the spreading habit of growth, often forming broad, dense masses of not more than a couple of feet in height. The colouring of foliage is at all times beautiful, though varying greatly in different plants—sometimes a rich greenish-brown, relieved here and there by silvery tones, at others a uniform greyish-green, the dainty and delicate leaders alone being of a rich, warm brown. The leaves are stout, sharp, and thickly arranged, varying in length and width, each being about three-eighths of an inch long, green or greyish-brown on one side, and of a beautiful and distinct silvery tone on the other. Berries are produced very freely, in some cases constituting dense masses, the colour varying with age from green, through purplish-olive to a deep, glossy black, and each about the size of a pea. Both fruit and foliage emit a pleasant myrtle-like aroma when bruised.

**J. communis canadensis.**—In habit and general outline this bears a great resemblance to the Savin (*J. Sabina*), while the leaves are stiff, narrow, and sharp-pointed, grey-green in colour, with a silvery band on the upper side. The growths are very irregular in length, thus causing the plant to have a straggling, and by no means pleasing, appearance.

**J. communis compressa** must be considered as the dwarfest of all hardy conifers, it rarely exceeding a few inches in height. It is of compact conical habit, a specimen of 5 inches in height being about 2 inches in diameter of branch spread, the branchlets being slender, and growing close together in an upward direction. The foliage is thickly produced, the individual leaves short and bright green, changing in severe winters to a dull brown. The rate of growth, even under the best cultivation, is remarkably slow, yet the plant never wears a dumpy or cushion-like appearance, as is the case with the majority of pigmy conifers.

Many years ago I had a specimen of the above sent to me by a botanical friend, it being then 4 inches high, and as pretty a miniature conifer as could be desired. To-day it is hardly one inch taller, very little wider in spread, and of as beautiful a blue-green as when originally received. Considering that it has been growing in the richest of leaf soil for several years and has hardly increased in size, one cannot but wonder at the thickly-produced foliage remaining so fresh and healthy. For rock-work it is a gem, and must be considered as the dwarfest conifer known.

**J. communis cracovia.** Polish Juniper.—A decidedly ornamental variety, with an easy, half-pendulous, though upright mode of growth. The foliage is plentifully produced, and of a light green colour, but varies with the quality of soil in which the specimen is growing. In rather dampish loam, and where partial shade is afforded, it grows very freely, the foliage being thick and bright, and the branch tips gracefully pendulous, particularly those on the upper half of the specimen.

**J. communis hemispherica.**—This is a distinct variety, and one that keeps true to character. It only rises a short distance from the ground in a compact, almost globose mass, the leaves stiff, thickly produced, and of the same tint as those of the species, though not much over half as long. For rock gardening it is valuable, the rate of growth being slow, the outline compact, and the foliage pleasantly glaucous.

**J. communis hibernica.** Irish Juniper.—A well-known and widely dispersed variety of strictly columnar habit, the branches and branchlets being rigid, close set, and of decidedly upright growth. But not only in habit does this variety depart widely from the parent, for the foliage is also strikingly distinct, being shorter and of a deeper green, freely intermixed with silvery glaucous tints. This handsome and distinct form is said to have originated in Ireland, but I have also found it wild at Keston, in Kent, and on some of the commons of Hertfordshire.

**J. communis nana.**—A neat little shrub, of spreading growth, the leaves being short, and so sharp and needle-like that it is difficult to handle the plant uninjured. The colour of foliage is greyish-green beneath, and more glaucous above. Though rarely rising to a greater height than 8 inches from the ground, yet on the Snowdon range of hills I have seen it spreading to 5 feet in width. It transplants freely, and is useful for covering dry gravelly and chalky banks where little else would grow.

**J. communis neaboriensis** is a distinct and desirable variety of pyramidal growth, and remarkable for the stiff and very sharp-pointed leaves, which are of a shining glaucous green. It succeeds well under ordinary treatment, and forms a neat and pleasing specimen of upward growth.

**J. communis oblonga.**—This is a striking and beautiful form when seen in a thriving condition, which, unfortunately, is not always the case in this country. In shape it varies considerably, some specimens being decidedly procumbent, while others shoot up narrow and compact. It is, however, always pleasing, from the rich bright green of the foliage and the dainty grace of the slender branchlets. For a cool, porous soil it is a good subject.

**J. communis suecica** resembles the Irish juniper in habit, though the branch tips jut out here and there, giving the specimen an easier and less stiff outline. It is of larger growth, and the foliage lighter, greyish, or silvery-green.

**J. drupacea,** Labillardière. The Syrian Juniper. (*Synonym:—Arceuthos drupacea*, Antoine and Kotschy). Northern Syria, Crete. 1854.—In several respects this species must be considered as one of the most interesting of the junipers. It is of bold, upright growth, with a well-formed tree-like stem, and produces large plum-like fruit, quite distinct from any other of the family. The Syrian juniper is often said to be of slow and small growth, but in this country, at least, this is not always the case, for a specimen that has long been under my observation has, in thirty years, attained to a height of 21 feet, the stem girthing 25 inches at one yard from the ground. Perhaps the worst fault of this species of juniper is the early loss of the lower branches after a height of 12 feet or thereabouts is reached, and this loss of branches is general, and it was noticeable in every specimen that I know of. Usually the habit of the Syrian juniper is upright, not stiffly so, but just sufficient to impart a neat appearance to the tree. The branches incline upwards, and the branchlets slightly droop; the foliage is thickly produced—crowded, in fact. The leaves vary much in length, according to their position, but they are, for the greater part, $\frac{3}{4}$ of an inch long, stiff, sharp-pointed, and of a uniform grey-green colour, and quite wanting in the various tints of silver or frosted appearance possessed by many species of juniper. The fruits are sparingly produced even on old specimens; but when in any quantity, the tree has a beautiful appearance from contrast between the large blue-black berries and the light green foliage. The fruits are almost spherical, except at the apex, which is deeply cleft or indented, are fully $\frac{3}{4}$ of an inch in diameter, and often become suffused with a glaucous bloom just before they ripen.

For ornamental purposes, in sheltered spots, and in stiff soils, I would recommend *Juniperus drupacea* to be planted, as being a tree of robust and stately growth.

**J. excelsa,** Bieberstein. (*Synonyms:—J. taurica* and *J. religiosa.*) Levant, Himalaya, Afghanistan to Sikkim.

1806.—This is usually found as a pyramidal-shaped bush or tree, with numerous slender rigid branchlets, the peculiarly glaucous leaves imparting a greyish appearance to the whole.

When raised from seed in this country, the appearance of all the young plants is wonderfully alike, which is rather singular when we consider the wide range of the plant from Greece to Afghanistan.

**J. excelsa stricta** partakes of the neat, upright habit of the species, probably when young in an advanced degree, with still more glaucous foliage.

**J. macrocarpa,** Sibthorp. Mediterranean Coast.—Although not generally recommended for cultivation in this country, yet that it does succeed well in certain places is evident from the beautiful specimen that is growing but a short distance from the race-course at Sandown Park. It much resembles our common juniper, only the leaves are longer, and the fruit larger, while the more compact and better furnished appearance is strikingly pronounced in the specimen in question, which is 10 feet high and fully 7 feet through. The diameter of branch-spread is the same, or nearly so, from base to tip. Light sandy loam of great depth suits it well.

**J. occidentalis,** Hooker. (*Synonyms:—Chamæcyparis Boursierii*, Decaisne; *J. pyriformis*, Lindley.) North-Western America, British Columbia to Sacramento. 1839.—A very variable species, whether as regards outline or foliage. In young plants the leaves are sharp-pointed and brightly tinted, whilst in adult specimens they are of a sombre hue and closely imbricated. It usually wears a shabby appearance under cultivation in this country.

**J. occidentalis monosperma**, found on low hills of Southern New Mexico, becomes a low-growing tree, or rather medium-sized shrub.

**J. Oxycedrus,** Linnæus. (*Synonyms:—J. rufescens*, Link; *J. Marschalliana*, Steven, ex Boiss.) Southern Europe, the Levant.—A bushy, freely-branched, and wide-spreading shrub, the branchlets neatly drooping, and well clothed with needle-like leaves. It may be considered as the representa-

tive of our native Juniper throughout the districts in which it is found. Unless in seaside situations, it is rarely of satisfactory growth in this country.

**J. pachyphlœa,** Torrey. New Mexico and Arizona.—Owing to the intense glaucous hue of its foliage, this species is one of the most distinct and interesting of hardy junipers. The difference in colour between the old and young foliage is likewise remarkable, that of the young shoots for at least half the year being so intensely glaucous that it appears as if coated with hoar-frost, while the older is of a soft bluish-green.

Generally the habit is irregularly upright, rarely formally so, the branches comparatively short and erect, and the scale-like leaves, broad and short, stiff and sharp to the touch, and very closely arranged. The berries are produced in twos and threes, and resemble greatly, both in shape and colour, those of our common juniper, but they are twice as large, or fully ½ an inch in diameter, and in the young stage suffused with the same silvery-glaucous hue for which the foliage is so remarkable. This juniper is quite hardy, but has, with several other species, the unfortunate drawback, for ornamental purposes at least, that the lower branches give way even in specimens that are freely exposed to light and air. It is not averse to rather stiff soil, and to exposed situations.

**J. phœnicea,** Linnæus. (*Synonyms:—J. bacciformis*, Carr; *J. tetragona*). Mediterranean region, Azores, Madeira. 1683.—A well-known, shrubby-habited species, with much divided branches clothed with scale-like, bright green leaves, but which are quite wanting in the silvery tint that overlies the foliage of many members of this family. The fruit is usually produced in plenty, is of a yellowish-brown colour, and each of pea size. The finest specimens I have seen were growing on mossy ground on the slate rock where partially sheltered, and near the sea coast.

**J. recurva,** Hamilton. Weeping Indian Juniper. Himalayas, Cashmir to Sikkim. About 1822.—This is one of the most distinct, beautiful, and valuable of the many species of

the genus. Although perfectly hardy, it is somewhat fastidious and difficult to manage, and like many others of its Chinese relatives, has its likes and dislikes, both as regards soil and situation, but these being favourable, no more easily cultivated tree or shrub will be found in the whole range of coniferous trees. The branches are somewhat irregular of growth, the branchlets recurved, pendulous, and feathery, and well supplied with loosely imbricated bluish or greyish-green foliage. The fruit or berries are oval-shaped, with one seed in each, are of a pretty, dark purple colour, and shown off well by the lightly tinted foliage. The tree is not, as stated by Gordon, Veitch, and others, dicœcious, but frequently produces male and female flowers on the same twig.[1] Three crops of berries are commonly found on the tree at one and the same time, some being green, others suffused with a bronzy tint, and the full ripe ones an enticing purple.

It likes a moderately shady and sheltered situation, or where all day long it will not be exposed to direct sunshine. Cool, loamy peat would seem to be the soil in which it does best. The largest and healthiest specimens that have come under my own notice are growing close to the Abbey at Woburn, and in front of the dwelling-house at Hafodunos,[2] away amongst the Welsh hills.

**J. recurva squamata** (*Synonym :—J. densa*) is a much-branched, decumbent variety, with stiff, unyielding branches, and very glaucous, rigid, sharp-pointed, scale-like leaves. It is of little value as a decorative shrub.

**J. rigida,** Siebold et Zuccarini. Mountains of Japan, 1861. — I much fear that the specific name of this Japanese conifer is responsible for its absence from many of our parks and gardens. It should, however, be remembered that the name rigida has nothing whatever to do with the

[1] For a full account of *Juniperus recurva*, see my article in *The Garden*, vol. xxix., 1886.

[2] There are many rare and beautiful conifers in the Hafodunos collection, and I was particularly struck with the great size to which *Tsuga Mertensiana*, *Juniperus recurva*, and many of the species of *Abies* and *Picea*, had attained at so high an elevation above sea level. *Sciadopitys verticillata* I have never seen in finer form.

habit or outline, but directly refers to the stiff, sharp-pointed leaves, which render the plant almost as difficult to handle as a bush of furze. It is at once one of the most distinct, hardy, and beautiful of the many species of *Juniperus*—indeed, I much question whether any other can surpass as a standard specimen a well-grown healthy bush of *J. rigida*. It has a warmth of foliage tint, and a gracefully irregular habit, shapely without formality, that renders it one of the most pleasing of small or bush-growing conifers. Usually it forms a bush of about 12 feet in height, with the diameter of branch spread almost equal from base to tip, the branches slightly ascending, and the branchlets and young shoots gracefully pendulous. A peculiar habit of this species is that some of the branches project further than others, but curiously enough, such branches are so regularly spread over the specimen, that any irregularity of habit is quite lost sight of, and this is further aided by the weeping tips which hang limp and free for several inches in length, and constitute an unusual and distinctive charm. Very beautiful, too, is the silvery sheen of the foliage that is brought about by the conspicuous glaucous furrow that is present on the upper sides of the leaves. Each leaf is $\frac{1}{2}$ an inch long, narrow, and very stiff, and terminating in a sharp point. At no period of growth is *J. rigida* more beautiful than during the months of June and July, for then the light green (almost of a yellowish tint) of the young growths contrasts markedly with the deep bright green of the older foliage, which later on assumes a warm brownish tint.

For ornamental planting I would place this only second to the better known *J. recurva*, but it has the advantage over that popular species in that it succeeds well in the very soil where the other becomes rusty and infested with red-spider.

By far the finest specimen that has come under my notice is growing in deep sandy soil near the race-course at Sandown Park; it is 13 feet high, and nearly 5 feet through, and is as perfect a specimen conifer as could be desired.

**J. Sabina,** Linnæus. (The Savin.) Central and Southern Europe, Caucasus, Siberia, North-Eastern America. Prior to

1548.—Though hardly worthy of special remark as an ornamental shrub, yet the Savin juniper has been put to good use for rock-work decoration, and for planting as game court around the margins of woodlands. In Woburn Park it is extensively used for this purpose. It is usually of irregular habit, portions of the shrub being dense and compact of growth, and others shooting away into long, almost erect shoots. The foliage is small and scale-like, while the partly concealed berry is of pea size, and purplish-brown in colour.

**J. Sabina tamariscifolia** is one of the neatest and prettiest varieties in cultivation, and in small gardens is worthy of a far larger share of attention than it has hitherto received. One must see healthy specimens to witness the intense bluish-green colour, suffused with a silvery tint, that pervades the whole foliage. For ornamental planting, this Spanish Savin is far more desirable than the species, being of neater and more procumbent growth, and the foliage tint much more bright and cheerful. Even under favourable circumstances, it rarely rises more than 15 inches from the ground, is oftener 9 inches high, and is wanting usually in the long jutting twigs which so mar the appearance of the typical plant. It makes a capital edging or carpeting shrub, a use to which I have successfully put it on various occasions. The branches when pegged down take root freely, and soon form breadths of the most pleasing green foliage.

**J. Sabina variegata** has no particular merit to recommend it, the yellowish variegation being spotty and irregular. It has the same habit as the species.

**J. sphærica,** Lindley. Northern China. 1846.—This is a distinct species of tidy outline, rather inclined to be conical, but relieved of formality by the extending, tufted, and finely-divided branchlets. The foliage is of a bright and pleasant green ; while the fruit, which is irregularly produced, is oval of form.

**J. sphærica Sheppardii,** as seen in cultivation, has a winter attraction that renders it of value where low-growing and brightly-foliaged shrubs are in demand. The leaves are

silvery-white, rather stiff, and sharp-pointed, while the branches and branchlets are numerous, and impart a dense, spreading habit to the specimen.

**J. thurifera,** Linnæus. Spain, Algiers. 1752.—This can hardly be generally recommended, as I have known well-established specimens to suffer much from frost. When seen at its best, it is highly ornamental, and of distinct habit of growth, from the lower branches being spreading, while those further up have an erect growth. The leaves are greyish-green and scale-like.

**J. virginiana,** Linnæus. North America, Hudson's Bay to Florida, and on the west side of Colorado and Vancouver's Island. 1664.—This is the largest growing of any of the junipers in this country; not only the largest as regards height, but as regards bulk of stem as well. Growing in deep, free soil, it has in Surrey attained to a height of nearly 50 feet, and with a stem girthing $7\frac{1}{4}$ feet at 3 feet from the ground. Although varying a good deal in shape and tint of foliage, the typical plant in England is of pyramidal form, with partially ascending branches, and mossy, deep green, and very varying foliage. The leaves are usually short and pointed, but often scale-like and imbricated, and both forms occur on the same twig. Berries are produced sparsely in this country, resemble small peas in size, and are greyish-brown in colour. From seed it varies to a wide extent.

**J. virginiana argentea** has the foliage here and there irregularly variegated with a silvery tint, but this, in the specimens I have seen, is neither constant nor distinct.

**J. virginiana aurea variegata** is irregularly tinted, particularly at the branch tips, with light yellow. Some forms of this tree are very ornamental, others not worth cultivating.

**J. virginiana Bedfordiana,** Knight. (*Synonyms:—gracilis; Gossainthainea; barbadensis.*)—This variety does well when planted in light, rich, sandy soil, soon forming a neat and attractive specimen. It differs greatly from the species in shade of foliage-colouring, and particularly in the

longer and more slender drooping branchlets. It is highly ornamental.

**J. virginiana glauca** differs from the species in being of finer growth, and in having the foliage decidedly glaucous, almost of silvery whiteness during spring.

**J. virginiana pendula,** of which there are several kinds, that of deep green colour being by far the most desirable, is extremely graceful, the branchlets being decidedly pendulous and the tree in consequence highly ornamental.

**J. virginiana Schotti** differs in being quite erect and compact of growth, with the foliage a bright green instead of the black-green of the species.

**J. virginiana tripartita.**—This resembles the common Savin in habit, being dwarf and spreading in growth. It is of very dense growth, with short, sharp-pointed leaves of a glaucous green colour.

## KETELEERIA (Carrière).

*Male* flowers in tufts or spikes.
*Cones* erect, lateral.
*Scales* partially persistent.
*Bracts* shorter than scales.
*Seeds* angular, winged.
*Leaves* flat, more or less two-ranked.
*Branches* horizontally arranged ; branchlets drooping.

An evergreen tree, with spruce-like cones and long-persistent scales.

**Keteleeria Fortunei,** Carrière. (*Synonyms :—Abies Fortunei*, Lindley ; *A. jezoensis*, Lindley ; *Picea Fortunei*, Murray; *Pinus Fortunei*, Parlatore.) Eastern China.—This is a distinct and interesting species, but one about which much difference of opinion exists, owing to the presence of certain characteristics which we associate with the spruce and the silver firs. Unfortunately the tree has not been found well suited for

cultivation in this country, it wearing, even in very favourable situations, a by no means prepossessing appearance. The branches are stiff and horizontally placed, and the foliage rather sparsely produced and irregular of arrangement, sometimes scattered, sometimes two-ranked. Each leaf is broad, flat, sabre-shaped, 1 inch long, deep green above, and lighter beneath. The cones are produced singly at the branch tips, stand half-erect, are 6 inches long by $1\frac{1}{4}$ inches wide, cylindrical, and with long-persistent scales, the bracts being shorter than these.

## LARIX (Miller).

### THE LARCHES.

*Flowers* monœcious; male catkins egg-shaped; females erect, solitary, ovate.

*Cones* somewhat cylindrical.

*Scales* leathery, persistent and undulated.

*Bracts* mostly lanceolate, longer or shorter than the scales.

*Seeds* without resin canals, with a leathery covering, and furnished with an oblong membranaceous wing.

*Cotyledons* five to eight, three-cornered, flat.

*Leaves* deciduous, tufted or singly, linear, soft.

Large growing deciduous trees, with the leaves arranged either singly or in bundles.

**Larix davurica,** Fischer. Siberia.—Neither in an ornamental nor economic sense can this be recommended for planting at all extensively. It does not thrive well, the growth usually being short, and the tree having a starved and stunted appearance.

**L. europæa,** De Condolle. Common Larch. (*Synonyms :—Pinus Larix*, Linnæus; *Larix excelsa*, Link; *Larix decidua*, Miller; *Abies Larix*, Poiret; *Larix pyramidalis*, Salisbury.) Central Europe and Northern Asia. Prior

to 1629.—Too well known to require description, at least for purposes of identification. As a hardy and valuable timber-producing conifer the larch is surpassed by no other tree that has been introduced to this country. The wood is very durable and strong, light in comparison with the bulk, and easily worked. As an ornamental tree it is certainly neglected, for in the spring months when the young leaves are bursting from the bud the decided golden green tint is almost unique in foliage tint amongst coniferous trees. Unfortunately of late years the larch has become subject to disease, and to such an extent that the planting of the tree in anything like its previous quantity is much to be doubted.

**L. europæa pendula** is a distinct and very handsome variety, having the branchlets hanging down almost at right angles to the branches, and for often a couple of feet in length. It reaches to almost the height of the parent tree, and should not be confused with the American species—the Tamarack or Hackmatack—which never attains to anything approaching such a size, but is of weeping habit.

**L. Griffithii.** Hooker. (*Synonyms:—Pinus Griffithii*, Parlatore; *Abies Griffithiana*, Lindley and Gordon.) Eastern Himalayas. 1850.—This bears a great resemblance to the weeping form of the European larch, but it rarely exceeds 40 feet in height, and in this country it does not succeed at all satisfactorily. The branches are long, lithe, and sparsely foliaged, while the cones are larger than those of any other species, and furnished with conspicuous persistent bracts. So far the tree does not promise well in this country, and is not to be recommended for any but the most favourable situations.

**L. leptolepis,** Endlicher. (*Synonyms:—Abies leptolepis*, Siebold and Zuccarini; *L. japonica*, Carrière.) Japan. 1861.—This is a beautiful species, and from what is already known of it, seems to be well suited for planting as an ornamental tree in this country. It is of slower and smaller growth than our common species, with longer leaves, and smaller and differently shaped cones, they being ovate, and

less than 1 inch in diameter. The long leaves make this species appear far more light and airy than the common form; while the young foliage is of a glaucous green, but this soon gives place to the darker colour of the mature specimen. In loamy peat it thrives well, but is usually slow of growth, although in south-western Scotland I have known fully 2 feet to be added to the height for several successive years.

**L. occidentalis,** Nuttall. (*Synonyms:—Pinus Larix*, Douglas; *L. americana brevifolia*, Carrière; *Pinus Nuttallii*, Parlatore.) British Columbia, Oregon.—In its native country this is a large-sized tree, the timber of which is said to be of great economic value, being largely used for fencing and railway ties. The thick, coarse bark is a peculiarity of the tree, that has the protective merit of long resisting forest fires. Young trees grow freely in this country when planted in good fresh loam. The foliage is light and feathery, and the cones, judging from specimens that have been forwarded to me for comparison, are longer than those of either our common species or the American black larch.

**L. pendula,** Salisbury. American Black Larch, Tamarack, or Hackmatack. (*Synonyms:—Pinus microcarpa*, Lambert; *Larix microcarpa*, Forbes; *L. americana*, Michaux; *Abies pendula* and *A. microcarpa*, Lindley and Gordon; *Pinus laricina*, Duroi; *P. pendula*, Aiton.) Eastern North America. 1739.—This is a valuable species in its native country, but has never found much favour with planters here, and is rarely seen in our woods and plantations.[1] As seen in this country it is usually of closer growth than our common tree, the branches rather tortuous and drooping, and the foliage of a greyish-green colour, and such as to at once strike one as out of the common. It grows best in swampy ground, and produces a very valuable timber that is extensively used for railway purposes in America. For much valuable information regarding this and other species of American larch I am indebted to Mr. Buchanan of Ontario.

[1] At Boynton, the property of Sir C. W. Strickland, both the black and red American larches have, in certain situations, done well and attained to large dimensions.

## LIBOCEDRUS (Endlicher).

THE INCENSE CEDARS.

*Flowers* monœcious; male catkins cylindrical or nearly so; females solitary, globular.

*Cones* oblong, woody, and composed of from four to six scales, of which the middle pair alone is fertile.

*Scales* leathery in texture, face to face in opposite pairs, and furnished with a terminal incurved point.

*Seeds* unequally two-winged, singly or in twos under each scale.

*Cotyledons* two.

*Leaves* flattened, decussate, in four imbricated rows.

Large evergreen trees, with flattened branches and scale-like leaves.

**Libocedrus chilensis,** Endlicher. (*Synonym:—Thuya chilensis*, Don.) Chilian Andes. 1847.—Although not to be relied upon as perfectly hardy generally throughout this country, yet the present species is well worthy of culture in suitable situations in our southern or western counties. It is highly ornamental, forming in a young state a very distinct and graceful plant of pyramidal outline, the habit of growth being neat and pleasing, and with glaucous deep green pointed leaves, which are of a silvery tone beneath. The cones are oblong, and $\frac{3}{5}$ of an inch in length. Cool, rather moist soil and partial shelter are necessities to its successful cultivation.

**L. decurrens,** Torrey. (*Synonyms:—Thuya Craigiana*, Murray; *Thuya gigantea* of gardens.) Mountains of North-Western America. 1853.—As seen in this country, where it has long been confused with *Thuya gigantea*, this is of dense, columnar habit, with short frondose branches, and deep green foliage, which colour is retained throughout the winter. Cones erect, oblong, an inch in length, and composed of usually two pairs of scales. The stem is usually carrot-shaped in this country, and the bark a rich brown, that gleams out here and there between the tiers of thickly matted branches.

The outline of the tree is rather stiff and columnar for ornamental planting; and though the timber is valuable, the rate of growth is too slow to allow of its being cultivated for profitable purposes in this country. It succeeds best on deep, moist loams, the foliage being paler and the lower branches apt to die off when the tree is growing in sandy or gravelly soils. There is a variety named *L. decurrens glauca.*

**L. Doniana,** Endlicher. (*Synonym:—Thuya Doniana*, Hooker.) New Zealand. 1848.—Though usually described as tender, there are, in certain parts of the country, well-furnished and beautiful specimens of this tree to be seen. In the north of Ireland it forms a handsome specimen, with foliage of the richest description; while in Southern and especially Western England, I have seen well-grown plants. It presents a perfect pyramid of flattened, fern-like branchlets, thickly covered with beautiful foliage of a deep, unchanging green, and with little or no silvery markings on the under sides. It is readily distinguished from *L. chilensis* by the more closely arranged leaves and by the absence of the silvery line on the under sides of these, as also by its richer and brighter green colour.

**L. tetragona,** Endlicher. (*Synonym:—Thuya tetragona*, Hooker.) Patagonia and Chili. 1849.—By the Chilians this is justly valued as one of the most important trees of their country, the timber being of great value for constructive purposes. In this country, unless in very favourable situations, it does not succeed well, and many specimens have died out prematurely. Where it does thrive, it is certainly a distinct and beautiful tree, of somewhat broadly pyramidal habit of growth, the branches being stiff, stout, and horizontally arranged, with the tips upturned. The leaves are bright green, broadly decurrent at the base, and about $\frac{1}{4}$ of an inch long. Cones smaller than those of any other species. I have seen this interesting conifer growing freely amongst decayed vegetable matter, and where the maritime situation was fairly sheltered.

## PICEA (Link).

THE SPRUCE FIRS.

*Flowers* monœcious; male catkins axillary or terminal; females terminal and solitary.

*Cones* generally pendent, solitary, and remaining intact for a long time.

*Scales* persistently attached to the axis, not falling away from each other as in the silver firs, broadly rounded, and with the edges undulated.

*Seeds* small, oblong, winged, with a bony shell.

*Bracts* free from the scales except at the base, and not projecting.

*Cotyledons* three-sided, and six to ten in number.

*Leaves* four-sided, pointing in every direction, and with circular projections at the base.

Evergreen trees or shrubs, with four-sided leaves, and usually pendent cones with persistent scales. As stated under Abies, the now universally adopted plan of calling the spruces Picea is here adopted.

**Picea ajanensis,** Fischer. (*Synonym :—Abies ajanensis*, Veitch.) Amoor Land, Mountains of Japan. 1861.—This is a distinct and beautiful conifer, of sturdy growth, and non-exacting as to soil. It is certainly one of the handsomest of the family, and even in mid-winter the beautiful glaucous foliage and curiously white-streaked stem have a striking appearance. When planted in an open space, for which it is peculiarly suitable, the plant usually assumes a pyramidal style of growth, the branches being well furnished with small branchlets or twigs, and all densely studded with the pretty and attractive foliage. Usually the branch tips have a distinct upward inclination, thus revealing glimpses here and there of the silvery under-sides of the leaves, and which afford a striking contrast to the darker tint of the upper and exposed sides. The leaves, which are fully ½ an inch long, and abruptly acute, are of a deep, pleasing shade of green above, and

silvery-white beneath, the latter being more pronounced and beautiful in this than almost any other member of the family. Both male and female cones are plentifully produced, the latter when fully grown, but before becoming ripe, being of a beautiful purple colour, and adding quite a charm to the specimen.

It is rendered, by its undoubted hardihood, freedom of growth, and beautifully furnished habit, a particularly choice species for planting as a standard specimen. The healthiest and largest tree of this kind that I have seen is growing at Ochtertyre, in Scotland.[1] *P. ajanensis microsperma* is a distinct variety.

**P. alba,** Link. (*Synonyms:—Abies alba*, Michaux; *A. canadensis*, Miller; *Pinus alba*, Lambert; *Abies rubra cærulea*, Loudon; *A. cærulea*, Forbes; *P. nigra glauca*, Carrière; *Abies arctica*, Murray.) Arctic North America, and South to New England. About 1700.—For planting in this country the so-called white spruce cannot be recommended, it being at the best short-lived, not very ornamental, and of no value as a timber producer. Growing in cool yellow loam, I have, however, seen a small number of specimens thriving nicely; but it should be stated that these were under fifteen years planted. It is of neat, conical outline, well branched, and the foliage like our common spruce, but much lighter in colour. Cones are produced freely, these being dull brown when ripe, and 1½ inches long. There is a variety *P. alba cærulea.*

**P. Alcockiana,** Masters. (*Synonyms:—Abies Alcockiana*, Veitch; *Picea bicolor*, Maximowicz; *A. acicularis* of gardens.) Mountains of Japan. 1861.—Whether this is a distinct species, or simply a form of *P. ajanensis*, cannot at present be well defined. The appearance of young trees, sent from a reliable source under the present name, is certainly different from that of *P. ajanensis*, the foliage being more needle-like and less flat, far more prickly, and the colour not so decided a silvery tint. It grows quite freely, and has formed a dense

[1] The collections of coniferous trees at Ochtertyre, Murthly Castle, and several other estates in Perthshire, are particularly rich; while the individual specimens have a more robust and healthy appearance than I have noticed in almost any other part of the British Isles.

specimen of regular outline, except for the upper branches, which project here and there beyond those further down, and the plurality of leading shoots. The young shoots of the present tree are flattish on one side, while those of *P. ajanensis* are rounded or cylindrical.

**P. Breweriana,** Watson. North Carolina, Siskiyou Mountains.—This is one of the most locally distributed of all the spruces. It differs from every other in the long pendulous branchlets, which hang thin and flexible from the main branch to a great length. The bark becomes of a warm reddish tinge with the advance of years; and the leaves, which resemble those of the Norway spruce, but of a lighter green, are scarcely 1 inch long, blunt, thick, and rounded. The cones are remarkably thin for their length, which is usually about 3 inches.

**P. Engelmanni,** Engelmann. (*Synonyms:* — *Pinus commutata,* Parlatore; *Abies Engelmannii,* Parry.) Rocky Mountains of Montana, Oregon, South to Arizona. 1864.— This tree resembles the black spruce of Eastern America, for which it was mistaken by all botanical travellers in the Rocky Mountains, until Dr. Parry detected its specific distinctions, and dedicated it to the distinguished botanist whose name it bears. In this country it forms a neat specimen of broadly conical outline, the branches being stiff, and the long foliage, sharply pointed and dull green of colour. The cones nearly resemble those of the better known *P. sitchensis*, and are about 2 inches long.

**P. Engelmanni glauca** is, in so far as ornamental properties are concerned, a far more desirable tree than the species. It is undoubtedly one of the most beautiful of all the spruces, the general habit being that of the parent, but the foliage, instead of being of a dull green, is distinctly glauscescent almost to silvery whiteness. It is very hardy, and in the younger stages slow of growth, with dense, stiff, horizontal branches, and stout, sharp-pointed leaves, which in their shade of silvery-green vary to a great extent. In many collections *P. pungens glauca* does service for the present variety.

**P. excelsa,** Link. Common Spruce. (*Synonyms:*—*Abies excelsa*, D. C.; *Abies Picea*, Miller; *Pinus Abies*, Linnæus; *Picea vulgaris*, Link; *Pinus excelsus*, Lamarck.) Mountains of Northern and Central Europe. Prior to 1548. —Whether as a hardy, shelter-giving tree, or for the quantity and quality of timber it produces, the common spruce must ever rank high in the list of exotic conifers that have been found suitable for culture in this country. It is well adapted for general forest planting, luxuriating at high altitudes, and not only acting as a capital nurse tree, but producing a fair quantity of valuable timber. When clean grown, the timber is valuable for temporary roofing and fencing, pit props, flooring, packing boxes, etc. As an ornamental tree the fine proportions and well-clothed trunk render it very effective, which are further enhanced by the intense green of the thickly produced foliage. It wants rich, moist soil.

**P. excelsa aurea** is a beautiful variety, of robust growth, and justly remarkable for the bronzy tint which pervades the golden foliage, this being most pronounced at the branch tips. This seems to be identical with the continental variety named *P. excelsa magnifica*, but of which I have only seen dried specimens.

**P. excelsa brevifolia.**—A plant of this sent to me certainly well bears out the name, the leaves being nearly one half shorter than those of any other known variety. The growth is remarkably slow, and the plant dwarf and compact in habit. It is not well known.

**P. excelsa Clanbrasiliana** is a dwarf variety of curiously irregular growth, but useful for certain positions. The short and slender branches are densely packed with needle-shaped leaves, each $\frac{1}{4}$ of an inch long, and of a light glaucous hue.

**P. excelsa elegans** attains to 8 feet in height, and is chiefly remarkable for its compact and fragile mode of growth and greyish slender leaves, which have an erect tendency.

**P. excelsa Finedonensis** has the young shoots of a bronzy or brownish-yellow colour; but this gradually

gives place with age to a bronzy-green tint. It is highly ornamental.

**P. excelsa Gregoryana** is of neat and very dwarf growth, rarely being found more than 2 feet high. The foliage is of a pleasant green shade, short, stiff, and arranged thickly on the branches.

**P. excelsa inverta** cannot be described as at all an ornamental variety, but it is highly curious and interesting, from the branches hanging down almost close to the main stem, and thus imparting to the tree a strange and striking appearance.

**P. excelsa Maxwellii.**—A very neat, dwarf-growing form of the common spruce has been sent out under the above name. Unlike several of our well-known pigmy varieties, the shrub in question remains at all times as hemispherical as if it had been trimmed by the shears, and never juts into irregular growths, as do many of the dwarf forms that are at present widely cultivated. It only grows 2 feet high, but is full and rounded, and fully 1 yard in spread. It is said to have originated in a New York nursery, and is rare in cultivation in this country.

**P. excelsa pygmæa** is the dwarfest form of the common spruce, rarely rising to more than 1 foot in height, but spreading laterally in a disproportionate manner.

**P. excelsa stricta** is of neat and quite compact growth, with glaucous green leaves. It is of unusual habit, but strikingly distinct and ornamental.

**P. Glehnii,** Schmidt. Island of Sachalin.—Little is yet known regarding this species, which was found by Glehn, who accompanied F. Schmidt in his travels in Sachalin and Amoorland. From the specimen that I have seen, the plant may be described as of rather dense growth, with four-sided, curved, and sharply-pointed leaves, each ½ an inch long, these being thickly arranged on the branches. The cones are dull brown, and about 1½ inches in length. Scales wedge-shaped, and with the bracts much shorter than these.

**P. Maximowiczii,** Regel. (*Synonyms:—Abies Maxi-*

*mowiczii*, hort. ; *Picea obovata japonica*, Maximowicz.)—This is a dull and unattractive species, and one that has not succeeded well generally in this country. The branches are short and stout, the leaves four-sided, ½ an inch long, stiff and sharp-pointed, spreading almost at right angles to the stem, and of a uniformly dull green colour. The cinnamon tint of the young shoots is pleasing.

**P. morinda,**[1] Link. (*Synonyms :—Pinus Smithiana*, Lambert; *Picea Smithiana*, Boissier; *Abies Khutrow*, Loudon; *Pinus Khutrow*, Royle ; *Abies Smithiana*, Forbes.) Himalayas from West to East. 1818.—As a handsome tree this beautiful spruce undoubtedly stands in the front rank, while its hardihood, rapidity of growth, and ease of culture, even claim for it from planters a greater share of attention than it has yet received. The gracefully pyramidal habit of the tree is rendered strikingly beautiful by the slender terminal and lateral branches, which hang down free and easy for often fully a yard in length. Spreading horizontally, the branches are well supplied with branchlets, which are slender and drooping, and furnished with rigid, incurved, deep green leaves, that average 1¾ inches in length. Cones cylindrical, 5½ inches long, 1¾ inches in diameter at thickest part, and shining brown when ripe. The russety-brown tint and large size of the cones impart quite a feature to the tree, while the thickly produced pollen cones are in early spring very showy and attractive. The cones ripen in February of the following year after they have been produced, and then fall to the ground, many, indeed the larger portion, of the seeds being retained intact, owing to the compactly arranged scales. The tree will not flourish when planted on light, sandy, or gravelly soils, the best appearance being put on in rather dampish yellow loam, but not in such as is surcharged with moisture. The timber is of no special value, and is dealt with in the chapter on coniferous woods in the present volume.

**P. nigra,** Link. Black Spruce. (*Synonyms :—Pinus*

[1] A detailed account of *P. morinda* by the present writer will be found in *The Garden*, vol. xxx., 1886.

*Mariana*, Du Roi; *Abies Mariana*, Miller; *Abies nigra*, Michaux; *Abies denticulata*, Poiret; *Picea rubra*, Link; *Pinus nigra*, Lambert; *Abies rubra*, Forbes.) Canada and North-East America to Carolina. About 1700.—In this country *P. nigra* is of slow and slender growth, regular in outline, but often with the lower tier of branches resting on the ground, and extending much further than those immediately above. The foliage is bluish-green, and the cones, which are produced in great quantity in this country, of a purplish colour when young, and nearly 2 inches long. The tree succeeds best in a cool, moist, loamy soil, and when so situated, and up to the age of forty years, its distinctive characters are very noticeable.

**P. obovata,** Ledebour. (*Synonyms:—Abies obovata*, Loudon; *P. Maximowicz* of gardens.) North-East Europe and Northern Asia.—This closely resembles the common spruce, and is by some botanists ranked as a variety of that species. The cones are, however, very different from those of the common spruce, being only 3 inches long, egg-shaped, and the scale-edges smooth. The branches have a curiously warted appearance, which forms another point of difference. It does not generally succeed in this country.

**P. Omorica,** Pancic. Servian Spruce. (*Synonym:—Pinus Omorica*, Pancic.) Mountains of Servia.—This nearly approaches *P. orientalis*, from which, however, it may be distinguished by the longer leaves and shorter cones. The growth is slender, and branch spread narrow, while the leaves are fully $\frac{1}{2}$ an inch long and silvery green. The cones are $1\frac{3}{4}$ inches long, by fully $\frac{3}{4}$ of an inch in diameter, and of a warm, reddish-brown colour. It is rare in cultivation.

**P. orientalis,** Carrière. (*Synonyms:—Abies orientalis*, Poiret; *Pinus orientalis*, Linnæus; *Abies Wittmanniana*, hort.) Mountains of the Taurus and Caucasus. 1839.—Although of no particular value in an economic sense, yet for ornamental purposes or for planting on poor gravelly soils where perhaps no other member of the family could for long survive, this species is well adapted. The habit is dense and somewhat formal, though the branches ramify considerably, and usually the

appearance of fair-sized specimens is irregularly pyramidal. Of a dark glossy green and slightly paler beneath are the thickly arranged leaves, these being stiff and $\frac{3}{8}$ of an inch in length. Cones pendent, $2\frac{3}{4}$ inches long, by $\frac{3}{4}$ of an inch in diameter at thickest part, ovate-oblong, and tapering gradually to a point. They are, in a young state, thickly covered with resin, so much so that both the shape and size are quite lost to view, this, however, ultimately disappearing. This tree suffers much from stem-pruning; indeed, more so than almost any other of its tribe, resin oozing in quantity from the wound long after amputation of a branch has taken place. The timber is of fair quality, and resembles that of the Norway spruce; but the rate of production is slow, a height of 50 feet having only been attained under very favourable conditions in forty-three years. The tree being very sturdy and hardy, is well suited for standing alone, even in exposed situations where many other conifers would suffer considerably.

**P. orientalis aurea** has many of the branch-tips suffused with greenish yellow. It is a worthy variety.

**P. orientalis pygmæa** is of dwarf neat growth, and makes an excellent border or rock shrub.

**P. polita,** Carrière. (*Synonyms:—Abies Torano*, Siebold; *A polita*, Siebold and Zuccarini.) Mountains of Japan. 1861.—This is one of the handsomest and hardiest of the Japanese conifers. The branches are stout and horizontally arranged, the leaves long, curved, and four-sided, broad at the base, tapering to a stiff point, and pale green in colour. Cones $3\frac{1}{2}$ inches long by $1\frac{1}{4}$ inches broad, at first erect and pale green, but afterwards pendent and ruddy-brown in colour. A distinguishing characteristic is the large, globose, reddish-brown buds. The tree is of slow growth when young, but after the age of about ten years it shoots away freely, and is then a distinct and handsome specimen for the lawn or park.

**P. pungens,** Engelmann. (*Synonyms:—Picea Parryana commutata* of gardens; *Abies* or *Picea Engelmanni* of gardens.) Mountains of Wyoming, Utah, and California.—

This is a very accommodating species, and one that has been found well suited for ornamental planting in every part of the country. It is of somewhat stiff outline, owing to the rigid and horizontally arranged branches and branchlets, while the stout, sharply-pointed leaves still further add to the appearance. The leaves are in colour much like those of the Douglas fir, and the cones are fully 2 inches long.

**P. pungens argentea** is certainly the handsomest of the spruces, while it is of good habit though bold and shapely of growth. The pronounced silvery-tinted leafage is the main character for which this variety is so justly remarkable.

**P. pungens glauca** differs only in the rigid, sharp-pointed foliage being of a beautiful, bluish-grey tint. It is a highly interesting and choice variety, and being very hardy and free of growth, can be recommended for planting where less hardy conifers would not exist.

**P. sitchensis,** Carrière. (*Synonyms:—Pinus sitchensis*, Bongard; *Abies Menziesii*, Lindley; *Pinus Menziesii*, Douglas; *Abies sitchensis*, Lindley and Gordon.) Alaska to California. 1831.—Planted in cool, moist loam and where not subjected to long-continued and cold winds, this useful conifer thrives well; whereas when the soil is light and warm the foliage becomes meagre in appearance, affected by red spider, and almost semi-deciduous. When well grown, the appearance of the tree is both distinct and desirable, the stiff and rather irregularly disposed branches being thickly beset with vivid bluish-green foliage. Individually the leaves are remarkably stiff and sharp-pointed, bluish-grey above, and with two silvery lines on the under side. When ripe, the cones are russety-brown, nearly cylindrical, 3 inches long by 1 inch diameter, and invariably bent or curved. The male catkins are pendulous, and plentifully produced about the first week of April, when they impart a most interesting and beautiful appearance to the trees on which they are borne in quantity. The timber produced in this country has no special claims to distinction, being rough grained, though fairly durable. According to the soil and site so will be the growth of the

tree, and I have known a specimen that was planted under exceptionally favourable conditions to attain the height of 43 feet in twenty years.[1]

## PINUS (Linnæus).

### THE PINES.

*Flowers* monœcious; males in catkins; females solitary and terminal.

*Cones* woody, conical in shape, usually ripening in the second year.

*Scales* persistent and imbricated.

*Seeds* with a hard, bony covering, oval in shape, and usually furnished with an ample wing, or wingless.

*Cotyledons* entire, variable in number.

*Leaves* in tufts, persistent, and in sheaths of two, three, or five in number, seldom only one.

Evergreen trees or shrubs, with the leaves in tufts of two, three, or five.

**Pinus albicaulis,** Engelmann. (*Synonyms:—P. flexilis*, Murray; *P. cembroides*, Newberry; *P. Shasta*, Carrière; *P. flexilis albicaulis*, Engelmann.) Coast ranges of British Columbia, Sub-Alpine belts of the Rocky Mountains and Sierras.—In a young state this is a neat-growing tree of rather pronounced conical outline, with the lower branches horizontal and the upper ascending. The appearance of the foliage is like that of *P. cembra*, being in colour a dark rather sombre green, each leaf fully 2 inches long, but in this as well as size of cone it varies to a wide extent. Usually the cones are 4 inches long, but I have seen other specimens from old and stunted trees that were not half that length. It is of no particular value for ornamental planting in this country, the

[1] In a letter received from the Hon. Mark Rolle, *P. sitchensis*, *P. morinda*, and several other species have, judging from the measurements given, done well, and attained to large size at Bicton, in Devonshire.

oldest and largest trees usually wearing a curiously distorted appearance, that is mainly brought about by the long, lithe, and twisted branches.

**P. Ayacahuite,** Ehrenberg. (*Synonym:—P. strobiliformis*, Engelmann.) Mexico, Guatemala. 1840.—This is a distinct and beautiful species, reminding one, except in its longer foliage and cones, of the better known *P. Strobus*. The branches are whorled, and evenly arranged on the stem, while the leaves, which are five in a sheath, and of a desirable glaucous-blue tinge, are about five inches long, and produced plentifully. The cone is strikingly handsome, that now before me, a British-grown specimen, being 12 inches long and 2½ inches in diameter at the widest part. It is cylindrical in shape, produced on a ½-inch long foot-stalk, and of a warm brownish-yellow colour. The scales are ovoid, sharply-pointed, with the tips recurved. I am now fully convinced, after seeing specimens in various parts of the country, that the present species is far more hardy than is generally supposed; indeed, the localities and conditions under which it at present succeeds so well in this country are not such as would impress one as being extra well suited for the cultivation of tender plants.

**P. Balfouriana,** Murray. California, Mountains in Siskiyou County. 1852.—Although a distinct and in many ways a remarkable species, yet, as far as my own observations have extended, this must be considered as comparatively rare throughout Britain. It is quite hardy, but of slow growth, about mid-way in habit between upright and spreading; and owing to the thickly-arranged short tufts of leaves standing out at right angles to the branches and only towards the tips, these present a curious cylindrical or bottle-brush appearance. The short, falcate leaves, five in a sheath, are each not much over an inch in length, and of a soft shade of green, the inner face alone having a silvery tone. The cones vary in length, but are usually in the home specimens fully 2¼ inches, with protuberant, slightly-hooked scales, and when quite ripe are of a dark cinnamon brown; this also being the colour of the

bark on the older portions of the tree. In this country the tree is of neat growth, and though the annual increase in height is quite slow, yet the leading shoot is preserved, and the branches are regularly arranged for the full length of the bole.

**P. Balfouriana aristata,** growing alongside the former tree, is somewhat distinct, especially in the uniform light green of the leaves, these also being, for the greater part, longer than those of the species. The same arrangement of foliage is noticeable in both.

**P. Banksiana,** Lambert. (*Synonym :—P. hudsonica*, Poiret.) North-Eastern United States and eastern slopes of Rocky Mountains.—This is somewhat after the style of the better known *P. montana*, forming in this country a low, straggling tree rarely more than 20 feet in height. It forms no continuous trunk, but instead a number of thickened, gnarled, and twisted branches, the branchlets being sparingly supplied with light green leaves, arranged two in each sheath. This tree succeeds well in stony or rocky ground, for covering which it has been found of value.

**P. Bungeana,** Zuccarini. North China. 1846.—Where medium-sized conifers are desirable the present is certainly one of the most interesting, and, when well grown, it is a species of by no means unornamental appearance. In a young state it is of narrow outline, but with age gradually becomes more spreading, the lower branches lengthening out. The latter are, however, very apt to die off if the specimen is at all confined. The bark is light grey in colour, and peels off at stated intervals, this being a peculiar characteristic of the tree. The leaves are arranged three in a sheath, are perfectly rigid, and not more than 4 inches long, and, owing to their being tufted and a considerable space between each of the tufts, an unusual but very distinctive appearance is thus imparted. They are of a bright and pleasant green. The cones are ovoid, 2 to $2\frac{1}{2}$ inches long, with flattish-topped scales terminated by a small hooked prickle. The finest specimens that I have seen are growing in peaty soil in the open portion of a woodland in Ireland.

**P. Cembra,**[1] Linnæus. Mountains of Central Europe, Siberia.—This is a beautiful tree of neat growth, perfect hardihood, and one that succeeds in many soils and situations. There is a good deal of difference in the habit of various trees, some being of upright growth and others more spreading, but the usual type has the branches short in proportion to the height somewhat tortuous, and decidedly erect and appressed. Usually the leaves are five in a sheath, though sometimes four or six, stout and flexible, serrated at the margins, and nearly 3 inches long. Cones erect, of a beautiful bluish purple when of full growth but before becoming ripe, and varying much in size, but usually from 3 inches to 4 inches long, and about half that in diameter, and with large wingless seeds. The most suitable soil is that of a deep rich loam on a porous subsoil, but the tree is indifferent in that respect, for many fine specimens are to be found on gravelly and sandy loam if not too hot and dry, as also on chalky soils. Although British-grown timber is excellent in quality, yet the rate of growth of the tree is too slow in this country for it to be used at all extensively for afforesting purposes.

**P. Cembra pumila** (Kamtchatka and the Kurile Islands) is of small, compact, and neat growth, as usually seen in cultivation, and the foliage is more silvery than is the case with the species generally. The leaves are thin, $1\frac{1}{2}$ inches long, and the cones remarkably neat, being $1\frac{1}{4}$ inches long by 1 inch diameter. For confined spaces or rock-work this variety is to be recommended, the height rarely exceeding 4 feet.

**P. cembroides,** Zuccarini. (*Synonyms:—P. Llaveana*, Schiede and Deppe ex Parlatore; *P. osteosperma*, Engelmann.) Arizona. 1846.—This is of no great value for the purpose of ornament, and less so for the value of the timber it produces. As generally seen, it is of contorted and dwarfed appearance, with irregularly arranged branches, well furnished with nearly erect-growing, stiffish leaves, each fully $1\frac{1}{2}$ inches long, and bright green of colour. The cones are small, neat, and dull brown, each about $1\frac{1}{2}$ inches long.

[1] For a full account of *Pinus Cembra* and the variety, illustrated, see article of mine in *Woods and Forests*, March, 1885.

**P. clausa,** Vasey. (*Synonym :—P. inops clausa*, Engelmann.) Florida.—This bears a great resemblance to the better known *P. inops*, which in this country forms a low bushy tree of 16 feet, or thereabout, in height, the branch spread being nearly as much. The leaves of the present species are short and glaucous, arranged in twos, while the plentifully produced prickly cones are persistent on the stem and branches for many years; indeed so persistent are they that I have frequently seen them partially embedded in the wood of the branches on which they are growing. It grows in sandy barrens, and would no doubt be worthy of trial for planting in similar places in this country.

**P. contorta,** Douglas. (*Synonyms :—P. Boursieri*, Carrière; *P. Bolanderii*, Parlatore.) North-West America, Alaska to California along the coast. 1831.—Amongst medium-sized pines, and for planting where ground space is at all cramped, this species is valuable. The habit is irregularly conical, the lower branches having no decided mode of growth, but being short and spreading in almost every direction. In general appearance and foliage the tree bears some resemblance to *P. insignis*, but is of duller foliage-tint, the leaves arranged in twos, and thickly on the branches. Cones are produced freely, they being ovoid-conical, $2\frac{1}{2}$ inches long, and greyish-brown in colour The scales are formidable, the umbo being prolonged into a long, awl-shaped point. The tree varies a good deal in this country, and I have seen specimens which, from their depth of foliage colouring and neat narrow pyramidal habit, were highly prized by their owner. Planted in rough, stony, or rocky ground, it seems most at home, and under which conditions I have known the annual rate of growth to be 2 feet for several consecutive years.

**P. Coulteri,** Don. (*Synonyms :—P. macrocarpa*, Lindley; *P. Sabiniana Coulteri*, Loudon.) California.—This can hardly be classed as even a second-rate ornamental conifer in Britain, the shabby, meagre, tufted appearance of the foliage and the betrayal of bare branches being out of keeping with our ideas of a beautiful tree. Generally such is

the appearance of this species, although at times one may find passable specimens. The leaves are usually arranged in threes, but I have found them in fours and fives on the same tree, though rarely; stiffish, sharp-pointed, and 10 inches long. They are greyish-green, and for the greater part in clusters at the branch tips. The cones are justly remarkable, being of huge size and pretty colour, those from a home-grown tree being each 8 inches long by fully 5 inches diameter at widest part, and weighing about 2 lbs. They are conical-oblong, hard as a piece of carved work, and of a pleasing and warm yellowish-brown tint. For many years they remain closed, even when kept in a warm room, the hooked scales, which are nearly an inch in length, adhering firmly together. The tree is comparatively hardy in this country, and stands exposure well, as the fine specimen at Southborough, in Kent, clearly shows.

**P. densiflora,** Siebold and Zuccarini. Japan. 1854. —This is a distinct tree of massive and rounded contour, the upward-pointing branches being thickly set, the foliage reminding one of the bright bluish-green of certain forms of the Scotch pine, and to which, especially in a young state, it bears a marked resemblance. The leaves are two in a sheath, fully 3 inches in length; and the cones, which are often produced in small clusters, are 2 inches long, and of a light grey colour. This pine cannot long succeed when planted on cold or stiff soils, even although thoroughly drained, and I have known several healthy specimens to die out from this cause. Shelter, but not too close confinement, and light sandy loam, have been productive of the finest specimens in this country.

**P. edulis,** Engelmann. (*Synonym:—P. cembroides*, Gordon.) New Mexico, Colorado, Texas. About 1848.—In this country the present species forms a bush-like tree, as wide as it is high, which in a specimen at Penrhyn Castle in Wales is 16 feet. The trunk is short, with the main branches striking out at a height of 4 feet, these again being much sub-divided. The leaf arrangement is somewhat irregular, but usually there are three in a sheath, though sometimes two, each about $1\frac{1}{2}$ inches long, and of a peculiar greyish-green colour. Cones

oblong-globose, usually several in a whorl, 2 inches long by 1½ inches wide, and borne mostly in clusters of two, three, or five; the wingless seeds, which are ½ an inch long, closely resembling those of *P. Cembra*. The cone scales are hard, thick, and persistent, of a warm chocolate brown colour, and each provided with a five-sided umbo, which imparts a rough and uneven appearance to the cones. Rarely seen growing in this country, but from its neat bushy habit, when planted amongst rocky *débris* and in not too exposed situations, it certainly merits attention. Probably it would succeed best by the sea-side.

**P. excelsa,** Wallich. Temperate Himalaya. 1827.—This commonly cultivated species is readily recognised by the wide-spreading branches and wealth of long, pendulous, silvery-green leaves. The branch spread is wide in proportion to the height of the tree, and which, with the pendulous foliage and pale grey bark, impart to well-grown specimens a striking and pleasing appearance. The leaves are five in a sheath, 6 inches long, slender and limp, the edges rough, and of a desirable silvery-bluish tinge. For the cones, too, the tree is remarkable, these being produced freely even by young specimens, and owing to their great length and open character when ripe, and also to their peculiar yellowish-brown colour, give to the tree a decided characteristic that is not present in any other species. They are often as much as 8 inches long, by 3 inches diameter, and usually curved. For planting in rich, damp loam, and where an amount of shelter is afforded, this pine is valuable, but in too light soils and in exposed sites it wears anything but a pleasing appearance.

**P. flexilis,** James. (*Synonyms:—P. Lambertiana*, Hooker; *P. Lambertiana brevifolia*, Lindley and Gordon.) Eastern slope of Rocky Mountains, Montana to New Mexico, Texas, Utah, Nevada, Arizona. 1851.—Not generally cultivated in this country. When young, the tree has a Cembra-like appearance, but is far less symmetrical in branch arrangement. The leaves are fully 2 inches long, glaucous green, and plentifully arranged on the lithe and thin branch-

lets; while the cones are 3 inches long by nearly 2 inches through at the widest part.

**P. Gerardiana,** Wallich. North-Western Himalaya. 1830.—Though not generally hardy in this country, yet the fact of several fine healthy specimens existing at various places should be encouragement for a fair trial to be given to this interesting species. Probably it is rendered of greatest interest from the bark, as in *P. excelsa*, but to a much greater extent, being of a light greyish tint, and peeling off in long flakes. The leaves are long, about 5 inches, and stiff, while the cones are nearly globose and $4\frac{1}{2}$ inches in diameter. The largest specimens that I have seen are those on Sir William Verner's property in North Ireland; and anyone seeing these would at once be impressed with their distinctive characteristics and general hardihood.

**P. glabra,** Walter. South Carolina, Florida.—In this rare species the branches spread horizontally, and the branchlets are numerous, thus imparting a dense habit to the tree. The leaves are arranged three in a sheath, are slender, and from $2\frac{1}{2}$ inches to $3\frac{1}{2}$ inches long. Cones ovate-oblong, 2 inches long by 1 inch diameter at thickest part, and with relatively short foot-stalks. They are generally solitary. The bark is reddish-brown and furrowed lengthwise.

**P. halepensis,**[1] Miller. Aleppo Pine. (*Synonyms:*—*P. maritima*, Lambert; *P. Abschasica*, Fischer; *P. Pithyusa*, Strangeways.) Mediterranean, Caucasus, Levant, Afghanistan. 1763.—Though seldom seen in these Isles, yet there are many maritime estates where this distinct species would thrive well and form a handsome specimen.

In this country the tree is of rather upward mode of growth, and well supplied with long slender branches and short branchlets. The leaves are silvery-grey in colour, arranged two in a sheath, and about 2 inches long. Cones rounded at the base, ovate in shape, 3 inches long by $1\frac{1}{4}$ inches diameter, and placed on stout foot-stalks nearly 1 inch long. This pine

[1] An article of mine, with illustrations of the Aleppo pine, will be found in *Woods and Forests*, November, 1884.

has a light and airy appearance, caused by the branches being rather scantily furnished with leaves, more especially on the inner and lower portions, but this does not give a meagre or unhealthy appearance, but rather that of a refined and unusual aspect. The rate of growth in this country is by no means slow, the tree from which this description was taken having reached a height of 45 feet in thirty years. For planting in sandy soil by the sea coast it ranks as a valuable species, and has proved useful in this way both in Wales and Ireland.

**P. Hartwegii,** Lindley. (*Synonyms:*—*P. Ehrenbergii*, Endlicher; *P. Montezumæ*, Gordon.) Mountains of Mexico.—Generally this is not hardy throughout Britain, though here and there, particularly in Ireland, healthy specimens are to be met with. I have seen it doing well planted in an open field surrounded by woodlands and in free loamy soil. The appearance of healthy specimens is very ornamental, owing to the beautiful glaucous green, almost silvery leaves, which are arranged in tufts of five.

**P. inops,** Solander. Scrub Pine. (*Synonyms:*—*P. virginiana*, Miller; *P. variabilis*, Lambert.) North-Eastern United States.—In this country, at least, the present species cannot be ranked as an ornamental tree, the stout and twisted branches, and generally unfurnished and straggling appearance being the reverse of beautiful. The leaves are greyish-green, produced plentifully, and two in a sheath. A rather peculiar appearance is given to the tree by the prickly and thickly produced cones, which are often found in whorls far back on the branches, where they persist for many years. One of the largest specimens I have seen is growing on broken slaty rock with decayed vegetable matter, near the Penrhyn Slate Quarries in Wales.

**P. insignis,** Douglas. Remarkable Pine. (*Synonyms:*—*P. radiata*, Don; *P. tuberculata*, Don.) California. 1833.—A handsome, fast-growing conifer, but unfortunately one that in point of hardihood cannot everywhere be depended upon. The ornamental character of this species is universally admitted; indeed, it might well be described as the most

dainty and greenest of all pines, while it is probably the most rapid in growth. The leaves, two in a sheath, are slender and threadlike, of a bright, clear green, and 5 inches long; while the cones are the same length, $2\frac{1}{2}$ inches in diameter, and of a shining chocolate colour. It is certainly unfortunate that so noble and beautiful a tree has not been found generally hardy in these islands, and that it is, in consequence, but seldom planted except in the south and west. It also suffers from wind-waving, the head of foliage being heavy and the root-spread narrow. Too much coddling should be dispensed with in the cultivation of *Pinus insignis*, as, being apt to start early into growth, it suffers from our prevalent frosts in early May. A plantation composed entirely of the tree has done well on cold, late soil, and where freely exposed, in Sussex.

**P. Jeffreyi,** Murray. (*Synonym:—P. deflexa*, Torrey.) California. 1852.—A noble-growing tree, with stiff, short branches, placed far apart, and beautifully glaucous leaves, about 10 inches long, arranged three in a sheath. The cones are of a warm brown colour, 8 inches long, the bracts closely packed, and each terminating in a blunt spine. There is much general agreement in appearance between this species and *P. ponderosa*, particularly in the arrangement and length of branches; but close examination will show that in the *P. Jeffreyi* both leaves and cones are considerably longer. It is quite hardy, free of growth, and succeeds well on limestone or chalky formations.

**P. Koraiensis,** Siebold and Zuccarini. Korea, Kamtchatka, Japan. 1861.—This is a handsome and compact-growing tree, that forms a neat lawn or garden specimen in a short space of time. The branches are dense and short, and the leaves glossy green above, and averaging 4 inches in length. Cones 5 inches long, almost of equal diameter—$2\frac{1}{2}$ inches—throughout, and with the rich brown scales turned well back at their points. For ornamental grounds this species is well worth cultivating, the beautiful foliage tint and neat habit being special recommendations. In this country it does well in not too heavy nor damp yellow fibrous loam.

**P. Lambertiana,** Douglas. The Sugar Pine. California, Oregon. 1827.—With its giant proportions, distinctly glaucous green foliage, and large and beautiful cones, this species must be considered as one of the most ornamental of the genus. In England it has not usually succeeded well, although that there are numerous beautiful specimens would be folly to deny. It is of erect growth, the trunk being heavy and well formed, while the branches have a distinct horizontal, or, perhaps more correctly, downward tendency in growth, with the tips upturned. The slender leaves, arranged five in a sheath, are about 4 inches long, of a distinct shade of green, and for the greater part tufted near the branch tips. The cones are strikingly handsome, being in home-grown specimens from 12 inches to 14 inches long, cylindrical of shape, and with the bracts loosely arranged. Two seeds are beneath each scale, these being $\frac{3}{4}$ of an inch long. The bark is light grey in colour, resembling, as indeed does the whole tree, the better known *P. strobus.*

**P. Laricio,**[1] Poiret. Corsican Pine. Dalmatia, Servia, Thessaly.—Whether in an ornamental or economic sense this must be considered as one of, if not the most, valuable species that is cultivated in this country. It is of rapid growth, succeeds well in many classes of soils, even in that of gravelly composition, and produces a large quantity of excellent timber. In point of ornament this pine occupies a front rank, the finely rounded and perfectly straight trunk and thickly foliaged branches being different to almost every other species. The leaves are glaucous green, about 4 inches long, and produced in twos; while the light yellow cones are $3\frac{1}{2}$ inches long, by $1\frac{1}{2}$ inches in diameter, and tapering quickly to the point. The upright habit, narrow branch spread, and finely formed trunk, are points of special recognition, and which make this species so well suited for general forest planting. There are many varieties, the following including the best known and most useful.

[1] For monograph on the Corsican pine, and its value for afforesting purposes, by the present writer, see "Transactions of the Royal Scottish Arboricultural Society," vol. xii., part ii., 1886.

**P. Laricio austriaca** is readily distinguished by the prominent light grey buds, shaggy dark green foliage and well branched stem, the diameter of branch spread being often nearly equal to the height of the tree. The leaves are stiff and sharply pointed, fully 4 inches long, and produced thickly in twos. In most respects the cones resemble those of the species, but they are usually larger and of lighter colour. For the purpose of shelter this is a valuable tree, and when given plenty of room for branch-development it soon assumes a broadly conical mass of dark, almost yew-green foliage. The timber is rough in comparison with that of the species, due mainly to the weighty branches, and contains a great quantity of resin. It is an excellent seaside tree, and grows with great vigour on chalky soils.

**P. Laricio Karamana** is of low and rounded growth when compared with the species, the branches springing from the main trunk at only a short distance from the ground.

**P. Laricio Pallasiana** is of large growth, broadly pyramidal in habit, and with stiff, bristling foliage, and large cones.

**P. Laricio pygmæa** is of dense, compact, and quite dwarf growth, but of no particular value for ornamental planting, for which it is alone useful. The leaves are short and tufted, and of a greyish-green colour.

**P. longifolia,** Roxburgh. Himalaya.—This species is rarely found in collections of conifers in the British Isles, it being tender, unless in the most favoured localities. There are good specimens at Penrhyn Castle, North Wales, and at Churchill in the north of Ireland, thus showing that at least in certain districts its hardihood can be relied upon. The trees that I have seen are sparsely branched, probably from the distances apart at which the various trees were grown, thus showing off the trunk, the bark of which is of a light and warm colour. The foliage is, however, very beautiful and remarkable, being 16 inches long, of a silvery-green tint, and hanging in plumes from the branch tips. When viewed from a distance, this pine has a striking and very unusual appearance, from the great length and dis-

position of the foliage. In favourable places I have noted the upward rate of growth to be 10 feet in as many years.

**P. Massoniana,** Lambert. (*Synonym :—P. sinensis*, Lambert). China.—As seen under cultivation in this country, the present species is spreading, although neat in growth, well branched when growing in the open, while the rich pea-green of the foliage renders it a very distinct and pleasing object. The leaves are stout, 5 inches long, bluntly-pointed, and are borne two in a sheath, and these are so arranged that the general appearance of the tree is rather light and graceful than massive and dense. The cones are smaller than, but resemble those of, the Scotch pine, being hardly more than 1 inch long, with a short, stout foot-stalk, and they are produced singly at the tips of the branches, where they cannot readily be seen amongst the long needles.

Cones are produced at a comparatively early age, and a specimen under observation bore them when ten years old, at which time the height was 12 feet. Being quite hardy, and decidedly ornamental, this tree is worthy of being largely planted for special purposes at least.

**P. Massoniana aurea.**—This has justly been recognised as the best of golden variegated pines, the primrose-yellow colour of the leaves being sharply defined, and the contrast with the bright green very marked. A great advantage that it possesses over many other variegated conifers is, that the yellow tint becomes all the more pronounced on trees fully exposed to sunlight. As a specimen lawn tree this variety is of great value. Grafted on the common Scotch pine, it does well.

**P. mitis,** Michaux. (*Synonyms:—P. variabilis*, Pursh ; *P. echinata*, Miller ; *P. Tæda variabilis*, Aiton.) Eastern United States to Florida and Texas. 1739.—This species has no particular value here, whether in an ornamental way or for the value of the timber produced ; though in the latter respect it is one of the most precious of the North American pines. After the first ten years have been passed this tree seems to start and make headway in these islands, but

even then it cannot be called either beautiful or distinct. The leaves are dark and dull of colour, 3 inches long, and arranged two in a sheath.

It produces the "yellow pine" of commerce.

**P. monophylla,** Torrey. (*Synonym:—P. Fremontiana*, Endlicher). Sierra Nevada, Utah.—For planting in grounds of small extent this tree has several valuable qualifications. It is of low growth, never more than 20 feet high, strictly pyramidal when young, but becoming loose and rather straggling with age, the foliage being thickly produced and of an unusual and decidedly pleasing glaucous tint. Even in the reddish, scaly bark there is something out of the common with pines in general. The leaves are solitary and rounded, very rarely in pairs, and when so, semi-cylindrical and adherent for the greater part of the length, nearly 2 inches long, and of an oily or shining green tint. Contrasting markedly with the glaucous green foliage are the reddish-brown cones, each about 2½ inches long, with stout, thick scales, and large wingless seeds. The seeds are delicately flavoured, and supply the Indian tribes of the Sierra Nevada with an important article of food. In this country, where the tree is quite hardy, the finest specimens are growing on gravelly soil.

**P. montana,**[1] Duroi. (*Synonyms:—P. silvestris montana*, Aiton; *P. Mugho*, Poiret; *P. Pumilio*, Haencke; *P. Mughus*, Scopoli; *P. sanguinea*, Lapeyrouse; *P. uncinata*, Ram.) Sub-Alpine districts of Central and Southern Europe. 1779.—In gardens, under the above synonyms, the mountain pine is freely distributed, but as the so-called species and varieties are much alike, they are here classed under the present collective title of *P. montana*. The habit in this country is that of a wide-spreading and much branched bush of rarely more than 16 feet in height, many of the branches shooting out from the main stem at only a short distance from ground level, but with an upward inclination.

A distinctive feature of the tree is the very prominent ruddy buds, as also the rich tint of the ample foliage, which is

[1] For illustrated article of mine on *P. montana*, see *The Garden*, vol. xxx. 1886.

of a very dark and pronounced shade of green. Each leaf is fully 2 inches long, very stiff and stout, and closely arranged. Cones are only sparsely produced in this country even by old and well-established specimens, they being $1\frac{1}{2}$ inches long, and greatly resembling those of the common Scotch pine. Being quite hardy and very accommodating, this species has been largely used in the formation of game coverts, and for planting rocky, almost soilless ground where few other shrubs could succeed. For such purposes the spreading procumbent growth and thick, massy nature of the foliage render the tree peculiarly suitable.

**P. Montezumæ,** Lambert. (*Synonyms:—P. occidentalis,* Humboldt; *P. Devoniana,* Spach; *P. Russelliana,* Lindley; *P. pseudo-Strobus,* Gordon.) Mexico. 1839.—A rare and beautiful species, and one that varies much in almost every particular. As seen in this country, it is broadly pyramidal in habit, well branched even to the ground, and supplied liberally with bluish-green foliage, arranged in tufts of five. By reason of the great length of the leaves, 6 inches, and unusual shade of blue-green, a particularly striking aspect is imparted, and the tree cannot well be confused with any other species. The cones, which vary greatly in dimensions, somewhat resemble those of *P. halepensis* both in shape and size, they being $3\frac{3}{4}$ inches long by $1\frac{1}{2}$ inches diameter, and nearly smooth, or without an extension of the scale beyond the limits of the cone. As showing the variability in the size of the cone of this species, I might mention that home-grown specimens fully 4 inches long have been forwarded to me. It is to be regretted that so distinct and beautiful a species is not generally hardy in this country, for, except in the South or West, it rarely succeeds.[1]

The so-called species, *P. macrophylla,* with longer leaves and spiny cones; *P. Lindleyana,* with shorter leaves and smaller cones; *P. Wincesteriana, P. Gordoniana,* and *P.*

[1] *P. Montezuma* may be seen in vigorous growth, and about 40 feet high, both at Fota Island, Cork, and in the Isle of Man. Mr. Farrant, from the latter place, has furnished me with much useful information regarding such rare species as *Pinus patula, Picea religiosa,* and others that succeed well in that favoured spot.

*Grenvilleæ*, can only be recognised as forms of this very variable species.

**P. monticola,** Douglas. Vancouver Island, British Columbia, Oregon to California. 1831.—A distinct and beautiful hardy pine, that is well distinguished by its narrow branch spread and silvery-green foliage. In a specimen of 80 feet in height the branch spread is only 18 feet, though ample space has been allowed for development. The leaves are about 3 inches long, arranged in fives, rather rigid and rough on the margin. Cones are produced plentifully all over the tree, and resemble greatly those of *P. Strobus*, but they are smaller generally, being 5 inches long, nearly 2 inches in diameter, and cylindrical in shape. They are usually bent or curved. A peculiarity of the bark is that it splits into square plates, but is never ragged or untidy, and is of a pleasing ash-grey colour on the younger, and darker on the older portions. It produces timber rapidly, a specimen at Esher in Surrey having attained to fully 70 feet in height in forty years, and with a clean and well rounded bole that girths 7 feet at a yard from the ground. In dampish, loamy, or sandy soil it grows well.

As a timber-producing tree *P. monticola* is likely to attract attention, the quality of that produced in two widely different parts of this country being such as to warrant us in speaking highly of it. The tree is very hardy, several of the healthiest specimens I have seen being in the environs of Edinburgh. A variety with stouter and broader leaves and having the young cones purple instead of pale green as in the species, has been named *P. monticola porphyrocarpa* (Murray).

**P. muricata,** Don. (*Synonym:*—*P. Edgariana*, Hartweg.) California. 1846.—This is a very distinct tree not only from the massive well-rounded top, but on account of the large and informly arranged branches, which in most specimens break out from the main stem at a few feet from ground level. The thickly clustered, prickly cones, which adhere so firmly to the stem and branches that a good knock is required to free them, are unlike those of almost any other

species, and form a speedy means of identification. They persist for many years, and being arranged in whorls around both stem and branches, have a very unusual and curious appearance. The leaves are fully 4 inches long, bluntly pointed, and slightly serrated on the margins. For planting on rocky ground or even on poor sandy soils, this pine is valuable, but it wants protection from rough winds, as it is apt to get uprooted, the head being heavy in proportion to the height and root spread.

**P. oocarpa,** Schiede. (*Synonyms:—P. oocarpoides*, Gordon; *P. Skinneri*, hort.) Mexico, Guatemala. 1838.—This is a beautiful species, much after another Mexican pine, *P. Montezumæ*, but unfortunately it is not sufficiently hardy to withstand the rigours of our climate, unless in the south and west, and where good specimens of both are occasionally to be met with. The present species is of rather broadly pyramidal habit of growth, with the top wide, owing to many leading growths shooting up, and it is well branched down to the ground. The leaves are five in a sheath, rather harsh and rigid, and of a pleasing but not very bright shade of green. The cones are small and oval in shape.

**P. palustris,** Miller. (*Synonym:—P. australis*, Michaux.) Southern States of U.S.A. and Texas.—This is the species, the timber of which, under the name of "pitch pine," is so largely exported to this country. Unfortunately it is not a suitable tree for cultivating in these islands. It is of upright growth, but straggling and meagre in appearance, with long deep-green leaves, arranged three in a sheath. Planted in dampish, well-drained loam, and under unusually favourable circumstances, a few specimens have done fairly well both at Penrhyn Castle and Woburn Abbey.

**P. parviflora,** Siebold and Zuccarini. Japan. 1861.—Where a neat growing and well furnished conifer of medium size is required, the present species will be found one of the best. All over the British Isles it does well, and has in many places already attained to goodly proportions, and produced both male and female cones in abundance. The habit of

growth is somewhat conical, with long and slender side branches, that are well supplied with laterals. It belongs to the five-leaved section, each leaf being fully 2 inches long, inclined to become twisted, and of a beautiful glaucous tint above, and distinctly silvery on the under sides, but the depth of colouring varies greatly. The pretty purplish cones are remarkably even in outline. They are $2\frac{1}{2}$ inches long, by $1\frac{1}{2}$ inches wide. In early spring the beautiful yellow catkins are produced so plentifully that the tree wears quite a gay and interesting appearance.

**P. patula,** Schiede and Deppe. Mexico.—A soft and lovely tree, quite wanting in stiffness or formality, the long and gracefully pendulous foliage rendering it distinct from every other member of the family. It cannot be planted wholesale, as the experience of past winters has convinced us that, unless in the milder parts of these islands, its hardihood cannot be relied upon. Usually the branches ramify much, the branchlets being long and lithe, but even this does not cause the stem to look naked or bare, as the long, soft, delicately green leaves hang gracefully downwards for from 8 to 12 inches in length. The arrangement of the leaves is usually irregular, sometimes three and sometimes four being contained in one sheath. I have noticed that on the outer or exposed sides of the shoots the leaves are usually in threes, while on the inner they are in fours. The cones, which closely resemble those of the Austrian pine, are generally arranged in whorls of four, are $2\frac{1}{4}$ inches long, by $1\frac{1}{4}$ inches diameter, incurved, and usually pointing downwards. The bark of the branches is fawn colour, that of the stem leaden-grey; while an unusual appearance is presented in spring by the long, sharp-pointed and fluffy buds. This pine has succeeded from Edinburgh southwards, but the finest specimens I have met with are those in Cornwall[1] and the Isle of Man.

[1] Both at Menabilly and Carclew, in Cornwall, many of the rarer coniferous trees grow freely, and from the latter estate I have been sent fruiting specimens of the rare and beautiful *Pinus patula*. Unfortunately this handsome Mexican species has suffered much by the frosts of our late winters. The Carclew specimen is fully 45 feet in height.

**P. patula macrocarpa** has larger cones than the species, but otherwise the trees are much alike.

**P. Peuke,** Grisebach. (*Synonyms:*—*P. excelsa*, Hooker; *P. excelsa*, Peuke.) Macedonia.—This might well be described as a dwarf form of the better known *P. excelsa*, but under cultivation in this country the differences between the two are so well defined and constant that it is preferable to consider them as specifically distinct. In this country the tree is of neat form, with abundantly produced foliage, each leaf 3 inches long, the pendent, quickly tapering cones, about 3 inches in length by 1½ inches diameter at thickest part. From this description it will readily be perceived that in size, length of foliage, and dimensions of cones, *P. Peuke* differs sufficiently from *P. excelsa*.

**P. Pinaster,** Solander. Cluster Pine. (*Synonyms:*—*P. maritima*, Poiret; *P. Laricio*, Savi; *P. nepalensis*, Royle; *P. Latterii*, Madden; *P. Helenica*, Loudon.) Mountains and sea coast of Southern Europe, the Levant, etc.—For shelter-giving purposes, for planting amongst pure sand on the sea coast, and on shingly gravel inland, this is one of the most valuable species. It is a tree of giant proportions, with huge, unwieldy branches, ponderous trunk, covered with rough scaly bark, and usually a well rounded head of intense green foliage. The leaves are stout and stiff, 8 inches long, and produced in twos. A distinguishing characteristic of this pine is the large and densely clustered cones, they frequently occurring in groups of from 8 to 20, or more. Each cone measures 6 inches in length, and is of a warm cinnamon tint, the same colour, indeed, as are portions of the freshly exposed stem bark. The timber is of little value, but my experiments with it are recorded fully in the chapter on timbers at the end of this volume.

**P. Pinaster Hamiltonii** is a very distinct variety, but, unfortunately, one that has escaped the notice of planters to a very great extent. The well branched stem, rounded head, and distinct shade of green that pervades the foliage, are all points of distinction that cannot be lost sight of when comparing the variety and species. The leaves are shorter

and broader, and the cones smaller and ovate rather than truly conical, as in the species. A refined *Pinaster*, in which the massive, easy appearance of that tree is substituted by a formal and dressy aspect, explains well the character of the present variety. It withstands long-continued storms with almost perfect impunity.

**P. Pinaster Lemoniana** differs in the small erect cones being for the greater part produced singly. The cones are hardly 2 inches long by $1\frac{1}{4}$ inches diameter, and with unarmed scales, or, in other words, are nearly smooth of surface. Usually the tree is of small growth, with short leaves 3 inches long.

**P. Pinaster prolifera.**—This is not only a distinct but very remarkable form of the cluster pine, while at the same time, even under the very best cultivation, it cannot otherwise be described than as an ugly, wretched-looking, and ungainly tree. Some of the oldest specimens I have observed were growing near the remote village of Pentir in Carnarvonshire; but which, although ample room for development has been allowed them, are no ornament to the position they occupy, and in consequence several have already been removed. The largest hardly exceeded 30 feet in height, and all were remarkable for their contorted and half-dead appearance, caused by the stout, tortuous branches having died back, and yet remained in position for fully half the height of the tree. The immense clusters of small cones adhering to the long dead branches further added to the weird appearance of these pines; and in several instances I counted fully 60 cones in a single cluster of not more than 1 foot in length. In some of the cottages these huge clusters of cones were used as ornaments, that portion of the branch on which they grow being inserted in a wooden stand, and the whole varnished over. I counted 65 cones, each fully 2 inches long, in one of these ornamental clusters. Even in colour and shape the cones are exact miniatures of those of the species; the leaves are only about half as long, and the bark is of a very dark brown colour and flaked.

**P. Pinea,** Linnæus.—The Stone or Umbrella Pine of Europe. (*Synonym :—P. maderensis,* Tenore.) Mediterranean region, Madeira, Canaries.—As usually seen in this country, the stone pine forms a low-growing tree, the trunk dividing into numerous large branches at 5 feet or so from the ground, the extremities being thickly beset with foliage, the contour assumed being a bushy head of rounded appearance. The leaves, two in a sheath, are 4½ inches long, and of a warm, rich olive-green colour. Three years are required for the full maturity of the cones, which are then of a light reddish colour, 4 inches long by 3 inches in diameter. The cone scales are stout, and remarkably hard, and with two large wingless seeds beneath each, these being ¾ of an inch long, and containing a sweet and agreeable kernel. In the younger stages of growth the tree is somewhat tender. Sandy or gravelly soil suits it well. From samples of the wood of *P. Pinea* that I have had cut up, both at Penrhyn Castle and Woburn Abbey, it appears to be of fairly good quality, being light, from the small quantity of resin it contains, and in colour resembles the yellow pine of commerce.

**P. ponderosa,** Douglas. (*Synonyms :—P. Benthamiana,* Hartweg ; *P. brachyptera,* Engelmann ; *P. Beardsleyi,* Murray ; *P. Craigiana,* Murray ; *P. Parryana,* Gordon.) British Columbia, south and east, to Texas. 1827.—As an ornamental tree much cannot be said in favour of this species, the rather lax and tortuous branches, long foliage, and generally gaunt appearance imparting to it more of the picturesque than the beautiful. The leaves, which are almost wholly confined to the branch extremities, are somewhat rigid, varying in length from 8 inches to 12 inches, and of a dark glaucous-green colour. Cones small and ovoid, about 5 inches long, and the scales terminating in short, stiff spines. Generally hardy.

**P. pseudostrobus,** Lindley. Mountains of Mexico.—Not hardy unless in very warm and maritime districts. It is a handsome species of large and spreading growth, not unlike *P. Strobus,* but more silvery in appearance.

**P. pungens,** Michaux. Virginia, Carolina, and Penn-

sylvania. 1804.—The whole contour of this tree is irregularly spreading, with pale yellowish-green leaves, each 2½ inches long, placed thickly on the branches. The cones give a very unusual as well as formidable appearance to the trees, these being yellowish-brown, and arranged in whorls around both stem and branches. They are without foot-stalks, 4 inches long, by 3 inches diameter at the base, and tapering quickly to a sharp point. The scales are hooked. At only a few stations in this country have I known *P. pungens* to do at all well.

**P. pyrenaica,** Lapeyrouse. The Calabrian Pine. (*Synonyms:—P. Brutia,* Tenore; *P. carica,* Don; *P. Loiseleuriana,* Carrière.) Mountains of Southern Europe, the Levant, etc.—As seen generally in this country, the present species cannot be ranked as ornamental, while it is frequently confused with the totally distinct and far more valuable *P. Laricio pyrenaica.* The largest specimens of the true *P. pyrenaica* that I have seen, and from which these notes were taken, are growing on the Churchill property, in the north of Ireland. They are of untidy, informal appearance, with long and lithe branches; deep green, wavy leaves, 4½ inches long, and smoothish oblong cones, the scales of which do not project much beyond the general outline. By the sea coast it does well, and puts on a healthier and more clothed appearance than is the case when cultivated inland. The specimens above referred to were growing in black moory soil.

**P. resinosa,** Solander. (*Synonym:—P. rubra,* Michaux.) Newfoundland, Canada, to Pennsylvania. 1756.—This species thrives in a fairly satisfactory manner generally throughout the British Isles. It is of open character, the branches being long, and with a naked appearance, from the leaves being collected in tufts at their tips. The leaves are in twos, dark green in colour, and nearly 6 inches long; while the warm, cinnamon-tinted cones are each 2 inches long, and ovate-conical in shape. For planting on thin, gravelly soils, this is a useful pine, and has, in this country, been found well suited for mixing with such species as *P. Laricio*, *P. silvestris*, and *P. Pinaster.* The timber is highly prized in Canada, where it is known

under the name of the red pine; but in this country the lasting properties of home-grown wood have not yet been satisfactorily tested.

**P. rigida,** Miller. American Pitch Pine. (*Synonyms:—P. Loddigesii*, Loudon; *P. Tæda rigida*, Solander.) North America. 1759.—A highly ornamental and useful conifer in this country, and one that is singularly devoid of the stiffness and formality for which many species are so remarkable. The outline of the tree as generally seen in England, when allowed room for development, is somewhat after the style of our native species, the branches being arranged in no regular way, some assuming a spreading and others a pendulous mode of growth, and thus showing off the warm and pleasantly tinted bark. The leaves are arranged three in a sheath, are from $3\frac{1}{2}$ inches to 4 inches long, stiffish, and rich green in colour. In this country there are considerable differences in the length and colour of foliage in different trees, due mainly, I have noticed, to the soil and situation in which the particular specimens are growing. The cones, which are produced in groups of all numbers up to seven and eight, are 3 inches long by $1\frac{1}{2}$ inches wide, and with the scales terminating in small sharp-hooked spines. The tree is useful for growing on poor sandy or gravelly soils where only a very limited number of species could subsist.

**P. Sabiniana,** Michaux. California.—This species can hardly be said to be quite hardy, the healthiest and best grown specimens occurring either in Ireland or on the south or west coast of England. It is a beautiful tree, but wears a bare and naked appearance, from the fact of the foliage being mostly in tufts at the branch tips. The peculiarly graceful manner in which the tufts of foliage are arranged rarely fails to attract notice, for they grow almost upright for several inches, and then with the easiest grace fall backwards and outwards almost in a circle from the point where they originated, and for sometimes 10 inches in length. This imparts a weeping and airy appearance to the tree that is by no means readily explained, the foliage being of a rich bluish-

green hue. The cones are justly remarkable, for in the home-grown specimens now before me they are not unlike large, fully ripe pine-apples both in size and shape. Each cone is 8 inches long by fully 6 inches diameter at widest part, hard as yew, and the scales terminating in hooked points. They are of a light brown colour, and contain nearly 300 seeds, which are large and edible.

Light warm soils and well-sheltered situations must be chosen for this handsome species.

**P. silvestris,** Linnæus. Scotch Pine. (*Synonyms :— P. rubra*, Miller; *P. Mughus*, Jacquin; *P. rigensis*, Desfontaines; and many others.) Northern Europe and Asia, Britain.—A well-known species of very variable habit. The habit of the young tree is usually formal, the stem straight and the branches regularly arranged; but in old age, with the loss of the lower branches and increase in size of those near the top, the tree often presents a decidedly picturesque appearance, which is still further enhanced by the warm cinnamon brown of the bark. In the juvenile specimen the leaves are longer and more silvery in appearance than when the tree becomes advanced in growth. They vary in length from 2 inches to 3 inches, and are arranged two in a sheath. The cones vary greatly in size and shape, but are usually from 2 inches to 3 inches long, and 1 to $1\frac{1}{4}$ inches at widest part. Both as an ornamental tree and for the value of timber it produces, the Scotch pine will ever rank high with planters. It is, further, of undoubted hardihood, a good shelter-producer, and succeeds well on the thinnest and poorest of sand and gravel. The timber is greatly affected by climate, and that produced in northern Scotland is superior to what is grown either in England or Ireland.

**P. silvestris argentea.** The silver-leaved Scotch Pine.—This varies much in variegation, and many specimens have only a tinge of the silvery-whiteness for which the best variety is so much appreciated. The leaves of the young shoots in particular are creamy-white, but this to some extent gives way with the approach of winter.

**P. silvestris aurea.** The Golden Scotch Pine.—Amongst the many varieties of the Scotch pine none can equal the present either for free healthy growth or the beautiful golden tint which pervades almost every part of the foliage. The variegation is not inconstant, as is generally supposed, but is markedly distinct the whole year through; but that there are worthless forms offered by nurserymen is well known. This golden pine is beyond doubt one of the most ornamental conifers we have, the deep bluish-green of the normal foliage offering a marked and pretty contrast to the rich golden-yellow of the variegated leaves. It grows freely, a specimen that I have oft examined having for several years kept pace with the species alongside which it was planted.

**P. silvestris monophylla.**—This must be ranked as a very distinct, curious, and constant variety. At first sight it may readily be recognised as a form of the Scotch pine, the habit of growth being exactly similar, but the thin, open, and airy appearance at once strikes one as out of the common. This is due not to the leaves being produced singly, as the name would indicate, but to the majority of the pairs of leaves being united for almost their entire length, this imparting a more open aspect to the specimen. The cones, comparatively speaking, are sparsely produced, and decidedly more globular in shape (shorter and thicker) than those of the species. The tree stands exposure well, the largest specimen I have seen growing in quite an open situation near Hemel Hempstead, in Herts.

**P. silvestris pygmæa** is a very dwarf, rounded bush, with thickly arranged branches and comparatively short leaves.

**P. Strobus,** Linnæus. The Weymouth Pine. South-Eastern States of North America to Texas and Arkansas. 1705.—Both as an ornamental tree and for the quality and quantity of timber produced in this country, the Weymouth pine has received a considerable share of attention. It is perfectly hardy, free of growth, and not over-exacting as to the quality of soil in which it is planted. At a distance the tree is readily recognised by its light-grey, feathery appear-

ance and smooth ashen-grey bark. The leaves, arranged five in a sheath, are nearly 5 inches long, very slender, and of a pleasing, soft, silvery-green tint; while the cones are from 6 inches to fully 8 inches in length, usually bent or curved, and when growing exude resin freely. In some of the woods at Woburn Abbey, the Weymouth pine has reproduced itself from seed in large numbers, and these seedlings have been taken advantage of and utilised as forest trees.

**P. Strobus nana** grows to 5 feet in height, and is of dense globular habit when young, but apt to lose the lower branches with advancing years, and then assumes a less compact and pleasing appearance. The branches and branchlets are short and slender, and the leaves 2 inches long, and produced thickly at the branch extremities.

**P. Thunbergii,** Parlatore. (*Synonyms :—P. silvestris,* Thunberg; *P. Pinaster,* Loudon; *P. rubra,* Siebold; *P. Massoniana,* Siebold and Zuccarini.) Japan.—This is a rare tree in Britain, though in Cornwall and other warm maritime places, as also at Kew, good examples may be seen. The leaves are 5 inches long, rather tortuous, and deep green in colour. The cones, both in shape and size, resemble those of our common larch. All the specimens I have seen of this tree differ from *P. Massoniana*, with which it is sometimes included. *P. Thunbergii aurea* is a desirable variety.

**P. tuberculata,** Gordon. Oregon and west side of Californian coast ranges.—Amongst hardy or tolerably hardy species the present should be included, for in many parts of the country it has succeeded admirably, though in others it has failed to become established. Usually it forms a specimen of fully 20 feet in height, with a well rounded and thickly branched head, the lower portion of the trunk being destitute of branches, these after about twelve years' growth gradually, with a portion of the foliage, giving way. The leaves are bright green, nearly 6 inches in length, and the cones 5 inches long by 2 inches diameter at thickest part. The cones are produced in clusters, but sometimes straggling singly on both stem and branches, and persist for many years, those on

a specimen at Penrhyn Castle having remained in position and quite intact for fifteen years. The appearance presented by the annually increasing cones is very singular and curious.

## PODOCARPUS (L'Heritier).

*Flowers* dicœcious, rarely monœcious.

*Fruit* drupaceous.

*Seeds* hard, covered with a bony shell.

*Leaves* differing greatly in shape and arrangement on individual trees—opposite, alternate, or scattered; and linear or oblong.

*Cotyledons* two, leafy.

Trees or shrubs with leathery dark green leaves, but exhibiting great diversity of foliage. Natives of the temperate zones of Asia, Africa, and America.

**Podocarpus alpina,** Brown. The Alpine Podocarp. —Conifers from the Antipodes are not generally hardy in this country, but at the present time this distinct and very interesting Tasmanian conifer may be seen in excellent condition in an old-fashioned garden in the neighbourhood of London, and where it has stood unharmed for the past fifteen years. It is of low-spreading growth, with but little inclination to retain a leading shoot, the branches weak and pendulous, and the foliage thickly produced, yew-like in appearance, each leaf about $\frac{1}{2}$ an inch or 1 inch long, and dark green in colour. The prominent rib along the underside of the leaf is always present. The fruit is about the size of a cherry, with a single, bony-shelled seed within.

A very neat specimen of this highly interesting conifer has been brought about by side-pruning and tying the main leading shoot to a support, and as it bears pruning well the method is to be recommended when the flat-spreading habit is wished to give place to that of more upright growth.

Young plants are readily reared by laying the side branches in light sandy peat.

The Alpine Podocarp does very well when planted in light warm soil, but must not be exposed to cold winds, as the foliage then seems to suffer and become thinner and thinner on the branches.

**P. chilina,** Richard. (*Synonym :—P. salignus,* hort.) Andes of Chili. 1853.—This species is perfectly hardy in Southern England at least, and many fine examples may be seen from London southwards. Though rarely exceeding 10 feet in height, it is of robust hardy growth, usually taking the form of a dense bushy shrub of pyramidal outline. Near the ground the branches are horizontal, but further up they have a tendency to point skywards. They are well furnished with branchlets, and these with leaves, each being nearly 4 inches long by $\frac{1}{4}$ of an inch wide, and of a dark glossy green above, somewhat paler beneath. As a pot plant, and for town planting, it is particularly desirable. In many collections it is known under the name of *P. salignus ;* and is a decidedly ornamental and useful conifer for confined positions.

**P. macrophylla,** Don. Japan. 1804.—In situations similar to those described for the latter this species forms a pretty and interesting shrubby specimen. It is of rather strict growth, the branches formally arranged, and the thinly-produced foliage of a light greyish-green colour. Each leaf measures 4 inches in length, and is distinctly marked with two raised lines along the margins.

## PRUMNOPITYS (Philippi).

PLUM FRUITED YEW.

*Fruit* drupaceous in a loose spike, ovate, and greenish-yellow in colour.

*Leaves* shining green, slightly channelled on the under surface, with a glaucous line on each side of the narrow mid-rib.

*Branches* numerous, irregularly disposed, and covered with brownish bark.

An evergreen tree of yew-like appearance. There is only one known species, which has been referred to Podocarpus, but Professor Philippi, who should know best, has placed it in the present genus by itself.

**Prumnopitys elegans,** Philippi. (*Synonyms:—Podocarpus andina,* Poeppig; *Stachycarpus andina,* Van Tieghem.) Chili. 1860.—Though usually branded with the title of "half-hardy," yet in England at least such can hardly be applied, for the numerous fine specimens that are to be found around London prove beyond a doubt that this coniferous shrub may be planted with every chance of its succeeding well and forming in a few years a desirable and interesting specimen. For planting where ground space is limited, this conifer has proved to be exceedingly useful, the slow rate of growth, neat, usually pyramidal habit, and adaptability to the pruning-knife, all rendering it of value for such situations. It also thrives satisfactorily when planted in smoky and dusty localities, and may sometimes be seen potted up and offered for sale in Covent Garden market, it making a neat and effective pot plant, and one which, unlike many other conifers, does not change colour with the advent of winter. The leaves are thickly produced and almost yew-green above, and slightly silvery on the under sides, are flattened, fully $\frac{1}{2}$ an inch long, and subdistichously arranged. In the fruit we have something out of the usual way of coniferous trees, for these are bigger than sloes, ovate in shape, almost transparent, and with the kernel contained in a hard cherry-like stone. The largest specimen I have seen was 18 feet in height.

## PSEUDOLARIX (Gordon).

THE FALSE OR GOLDEN LARCH.

*Flowers* monœcious; males in umbellate pendulous tufts.

*Cones* pendent, and composed of divergent scales like the head of the common artichoke.

*Seeds* with a soft, thin coating, and more or less enclosed by the wing.

*Leaves* soft and deciduous, scattered singly on the young shoots, but collected in bundles on the adult plant.

*Cotyledons* seven.

A beautiful deciduous tree, differing from the larch in the male flowers, being spike-like and in umbellate tufts, and in the cones having deciduous scales with divergent points.

**Pseudolarix Kæmpferi,** Gordon. The Golden Larch. (*Synonyms :—Larix Kæmpferi*, Carrière ; *Pinus Kæmpferi*, Lambert ; *Abies Kæmpferi*, Lindley ; *P. Fortunei*, Mayr.) Northern China. 1846.—This is a rare and beautiful tree, which, from the midland counties southwards, is perfectly hardy. It is a distinctly ornamental conifer, and that at three different periods of the year—early spring, when the tender green leaves are unfolding ; autumn, when they put on the lovely golden colour; and during the leafless period, when the yellowish-green or golden-brown bark of the younger branches shows off to perfection, and renders the trees distinct from almost every other species in cultivation. In this country the largest specimens have well-furnished stems of semi-pendent branches. The leaves vary in length according to their position on the tree, but are usually from $1\frac{1}{2}$ inches to 2 inches. From home-grown specimens of the cones that have been forwarded to me, the average size would be about 2 inches long by $1\frac{1}{4}$ inches broad ; but with the age of the cone and opening out of the scales the measurements vary much. They are composed of a number of diverging scales, each 1 inch long and half that in width, which, after the ripening of the cone, soon fall apart. The tree succeeds well in not too stiff loamy soil, and is by no means impatient either of shelter or shading.

## PSEUDOTSUGA (Carrière).

THE DOUGLAS FIRS.

*Male* flowers like those of Picea.

*Cones* pendent, persistent, ripening the first year.

*Scales* persistent.

*Bracts* long, two or three-pointed.

*Cotyledons* varying in number from five to twelve.

*Leaves* stiff, flattish, bright green, and more or less acuminate.

*Branches* whorled ; bark on young shoots glabrous.

This genus was constructed for the Douglas fir, the habit and foliage being nearly that of the silver firs, and the male flowers like those of Picea.

**Pseudotsuga Douglasii,**[1] Carrière. The Douglas Fir. (*Synonyms:—Abies taxifolia*, Poiret; *Pinus taxifolia*, Lambert; *Pinus Douglasii*, Lambert; *Pseudotsuga taxifolia*, Britton; *Abies Douglasii*, Lindley; *Picea Douglasii*, Link; *Tsuga Douglasii*, Carrière.) British Columbia to Colorado, Texas and Mexico. 1827.—Whether planted singly or in clumps, this tree is highly effective, the giant proportions, easy and graceful outline, and thickly-foliaged branches, of the deepest and richest green, being special points of attraction. Although perfectly hardy everywhere in this country, yet the Douglas fir cannot stand exposure to hard-blowing winds, the leader and upper branches under such conditions suffering greatly, and in many instances becoming almost destitute of foliage. The production of timber goes on at a rapid rate, and in this respect the tree is surpassed by no other grown in this country, fully 5 cubic feet per year having been produced over a period of fifty years. The timber too is of good quality, and the results of numerous experiments which I instituted for the purpose of testing this have been very satisfactory, and will be found in the chapter Timber of Coniferous Trees. When standing alone the tree has a tall, straight, and very gradually tapering trunk, the branches, which are horizontally arranged and decreasing in length upwards, being retained in a healthy condition down to ground level. The leaves vary in length

[1] A monograph on the Douglas fir, by myself, will be found in the "Transactions of the Royal Scottish Arboricultural Society," vol. xi., part ii., 1886.

from 1 inch to 1½ inches; while the freely-produced cones are pendent, 3 inches long by half that in width, and the scale bracts protruding for fully ½ an inch. With regard to soil, the largest specimens in this country are growing on gravelly loam. A new Douglas fir has recently been discovered in Japan, at an elevation of about 2,000 feet. It is described as of erect growth, with horizontally arranged branches.[1]

**P. Douglasii pendula** has the strictly drooping branches too stiff and straight to be classed as ornamental. It is, however, a very curious and interesting variety.

**P. Douglasii Stairii** is a beautiful variety in which the variegation is constant and well diffused, while the constitution is robust and the rate of growth rapid. Generally the tree is of a light yellow colour in spring, the young growths, for a time at least, quite hiding the darker tints of the older foliage. In no other respect does this variety differ from the species.

**P. Douglasii taxifolia** is a pronounced and decidedly distinct form of smaller and hardier growth, and so far likely to turn out a more useful tree for general forest planting in this country than the typical species. The tree is of sturdy and much slower growth than the parent, while the foliage is of a darker green and more massive. To be recommended for afforesting purposes.

## SAXEGOTHEA (Lindley).

PRINCE ALBERT'S YEW.

*Flowers* monœcious; male flowers in stalked cylindrical spikes; females in globular heads.

*Fruit* composed of thickened scales, formed into a somewhat fleshy cone.

*Seed* inverted, and springing from a cavity towards the middle of the scales.

*Leaves* resembling those of the yew.

An evergreen shrub of yew-like appearance.

[1] See "Tokyo Botanical Magazine," February 20th, 1895, for description and figure of the Japanese Douglas fir.

**Saxegothea conspicua,** Lindley. Prince Albert's Yew. Southern Chili. 1849.—This is a somewhat tender shrub, of low-spreading and irregular growth, and only suited for planting among light rich soil and in fully sheltered situations. It resembles the common yew except in the colour of foliage, which is much lighter, being in well-grown plants a greyish-green or silvery hue. The leaves are thickly produced and pointing forwards, each 1 inch long, and marked with two silvery lines beneath. One of the healthiest specimens I have seen was growing in light moory soil, and in a situation sheltered from cold winds.

## SCIADOPITYS (Siebold and Zuccarini).

THE UMBRELLA PINE.

*Flowers* monœcious; male spikes terminal; anther lobes two.

*Cones* solitary, elliptic or cylindrical, and obtuse at the ends.

*Scales* and bracts united into a lobulated mass, leathery, thin, and imbricated.

*Seeds* arranged in sevens under each scale, two-winged, and with a leathery covering.

*Leaves* twenty to thirty in a whorl, of peculiar structure.

This genus is at once remarkable in the verticillate rays of foliage, these being arranged in umbrella-shaped whorls.

**Sciadopitys verticillata,** Siebold and Zuccarini. The Umbrella Pine of Japan. Japan. 1861.—An interesting and highly ornamental tree that has done well, when planted in suitable soil, in almost every part of the country. Its special requirements are leaf soil or peat and an abundance of quickly passing away moisture. In this country the rate of growth is slow, but this is to a great extent counterbalanced by the strong though short shoots annually formed, and which become well ripened off before winter sets in. The form of growth is conical, the branches stiff and twiggy, with tufts of deep green foliage near the tips. Leaves arranged in double whorls, each leaf being 3½ inches long, leathery in texture,

and with two ribs. The cones vary in size up to 4 inches in length by fully half that in width. This is a distinct and desirable conifer, one that is hardy everywhere, and which well merits extended culture, from an ornamental standpoint at least.

## SEQUOIA (Endlicher).

*Flowers* monœcious; males in terminal, stalked, oblong heads.

*Cones* ligneous, sub-globular, and small.

*Scales* and bracts united, and forming a woody, wedge-shaped mass.

*Seeds* from three to nine under each scale, winged.

*Leaves* scattered, appearing in two rows.

Large-growing evergreen trees from California and North-west America.

**Sequoia gigantea,** Torrey. The Wellingtonia or Mammoth Tree. (*Synonyms:—Wellingtonia gigantea*, Lindley; *Sequoia Wellingtonia*, Seemann.) Western side of the Sierra Nevada Mountains. 1853.—Although of stiff and formal appearance, yet from its massive proportions and brightest of green foliage, the mammoth tree ranks high amongst ornamental conifers. As a timber tree it is not likely to attract attention in this country, it being ill fitted for withstanding cold winds, and in consequence unsuitable for entering into the composition of any but the most sheltered woodlands.

The tree has been in past years planted largely in our parks and gardens for ornamental effect, but with advancing years the aspect becomes less and less pleasing, and in consequence large numbers have been cut down and their places filled by other and more suitable kinds.

The trunk is straight, usually carrot-shaped, with brownish, stringy bark, and well supplied with slightly drooping branches and branchlets, the whole contour being sharply conical. Usually the leaves are spirally arranged and loosely

imbricated. The cones are obtuse, and vary much in size, but are usually about 2 inches long.

**S. gigantea aurea** is a distinct variety, but unfortunately, one that cannot be relied upon in so far as permanency of colouring is concerned, the beautiful golden-yellow of the branch tips of the juvenile plants gradually giving way with advancing age. I have seen several very beautiful specimens of this golden Wellingtonia, and if the character was constant the tree would be well worth cultivating for purely ornamental purposes. The best form I have seen was sent to me by Mr. Baylor Hartland, from Cork.

**S. gigantea pendula.**—Certainly one of the most curious of all conifers is the subject of the present note. It cannot be described as ornamental, at least when of large size, though young specimens are sufficiently curious and distinct to warrant more than a passing notice. As seen from a distance against the sky line, old trees have a very singular appearance, the long, pendulous, and irregularly-produced branches imparting an outline such as one rarely sees, unless associated with an isolated specimen that has for long been stranded on an exposed mountain side. Young trees are far more shapely and pleasing in outline, and though they cannot be described as ornamental, yet they are so very distinct that their presence in the park or garden is quite desirable. In all the specimens I examined the branches spring out directly at right angles to the main stem for a distance of about 3 inches, then turn abruptly downwards parallel and close to the stem for, in many instances, a distance of 4 feet. The foliage is quite normal, and the cones are $1\frac{1}{2}$ inches long, by fully 1 inch wide, and placed on a branch-like foot-stalk hardly $\frac{3}{4}$ of an inch long. A specimen about 30 feet in height may be seen at Berkhampstead, in Herts.

**S. sempervirens,** Endlicher. The Redwood of California. (*Synonym:—Taxodium sempervirens*, Lambert.) 1846. —A noble tree, that, when suitably placed, produces a large quantity of valuable timber in this country. Like the former species, it requires a certain amount of shelter, else the foliage

becomes thin and the tree stunted and starved in appearance.

When seen under favourable circumstances the redwood is of informal pyramidal appearance, with a well-formed trunk covered with thick, spongy, reddish-brown bark. In young trees the leaves are long and linear, while in those of older growth they are usually closely appressed, and of as deep a colour as the yew. The cones are about half the size of those of the former species.

In deep and rich soils, and where shelter is afforded, the redwood in this country is of truly noble growth, many specimens being over 80 feet in height, and with trunks over 4 feet in diameter. Unlike the generality of coniferous trees, the redwood sends up suckers from the base of the stem, and in consequence has been planted for coppice wood in Southern England.

**S. sempervirens adpressa.**—This is a distinct variety, with short, thick, and closely appressed leaves, which are of a very conspicuous shining bluish-green colour.

**S. sempervirens alba spica** has many of the branch tips of a yellowish white tint, but it is patchy, and of no particular value.

## TAXODIUM (Richard).

THE DECIDUOUS CYPRESSES.

*Flowers* monœcious; males in branched catkins; females two or three together near the base of the spike of male flowers.

*Cones* globular, with thick peltate scales.

*Seeds* two at the base of each scale, erect, angular, and wingless.

*Leaves* deciduous, in two rows, flat, and linear.

*Cotyledons* from four to nine in number.

Large-growing, swamp-loving trees, with deciduous foliage.

**Taxodium distichum,** Richard. The Deciduous Cypress. (*Synonyms:—Cupressus disticha*, Linnæus; *T. microphyllum*, Brongniart; *T. adscendens*, Brongniart.) Southern States of America. About 1640.—This is a tree of great beauty, the

soft, feathery foliage, which during summer is of a cheerful pea-green, slowly changing as autumn advances to a deep red, rendering it distinct from every other conifer in cultivation. Even during winter, when leafless, the tree is very attractive, for the highly-coloured bark of the branches and twigs is resplendent in the evening sunshine, and seen at a short way off appears as if all aglow. It is specially adapted for planting in swampy ground, by the lake or pond side, or on small islands, thriving under such conditions in a manner that is quite surprising. The habit of growth differs with the age of the specimen, young trees up to 25 feet in height keeping to the almost strictly pyramidal, while in many old specimens throughout the country the spread of the head is equal to, if not surpassing, that of any other portion. The foliage is always of a light and airy appearance, the pinnate leaves being arranged in horizontal rows on each side of the midrib. They vary in length even on the same twig, but are usually fully $\frac{1}{2}$ an inch long, closely arranged, and somewhat arching, with the convex side outwards. The cones are not freely produced, but home-grown specimens that I have collected are $\frac{3}{4}$ of an inch long, nearly the same in greatest diameter, and bearing small three-sided seeds. The Deciduous Cypress is remarkable in producing root protuberances, known as cypress knees, these sometimes in this country reaching to 2 feet in height, particularly when the tree is growing in a swampy situation.

**T. mucronatum,** Tenore. (*Synonyms:—T. Montezumæ*, Decaisne; *T. mexicanum*, Carrière; *T. distichum mexicanum*, Gordon.) Mexico.—This tree is amply distinct in cultivation from the hardier and more widely grown *T. distichum*, but with which it is often mixed up. It is of far more refined growth than that species, if I may use the expression, the branches and branchlets being shorter, more slender and horizontally arranged, and the foliage less abundant, and of a fresher green. The tree, too, is of much smaller growth, far more uniform in its branch arrangement, and with a very narrow spread in proportion to the height, this latter being a distinguishing characteristic. It is when the two

species are growing side by side that the differences can best be detected, and this is markedly the case both at Penrhyn Castle, North Wales, and Holwood Park, in Kent.

## TAXUS (Linnæus).

THE YEWS.

*Flowers* usually dicœcious; stamens in stalked heads; anther scales peltate.

*Fruit* solitary, one-seeded.

*Seed* erect, and borne in a fleshy open cup.

*Leaves* two-ranked, linear, and decurrent.

*Cotyledons* two, flat and leafy.

Evergreen trees or shrubs, with two-ranked leaves, and the seed borne in a fleshy cup or aril.

**Taxus baccata,** Linnæus. The Yew. Europe and Northern Asia, Britain.—This is a native tree, of about 40 feet in height, with a short, thick, and deeply-fluted stem, and a spread of branches often exceeding the height. It is a very accommodating tree, unusually large specimens being found growing where hardly a couple of inches of loam overlies the chalk formation, on rocky soils, shingly gravel, but best of all on good, sound, dampish loam, and on which latter it attains to largest dimensions. In the formation of evergreen hedges or for planting beneath the shade and drip of larger growing trees, the common yew is of particular value, and notwithstanding its rather gloomy appearance, is at the same time a decidedly ornamental evergreen tree, and one that imparts a rich and warm aspect to the landscape wherever it is used. Being of unusually slow growth, the annual layers of wood are comparatively thin and closely arranged, thus rendering the graining remarkably fine, which, coupled with the deep reddish tint of the wood, causes it to be largely employed for constructive purposes. When grown in the open, the tree is usually well furnished with branches almost to ground level, the branches being much sub-divided, and the ramifications

well furnished with dark green leaves arranged in two lateral double rows. The leaves vary in length, but are usually about 1 inch, with a prominent midrib, and tapering to an acute point. Fruit bright scarlet, oval or rounded in shape, and enclosing partially a small brownish nut. Whether when covered with the pollen-bearing receptacles in spring or the bright ruddy berries in winter, the tree is highly attractive and ornamental. The following are the most distinct varieties.

**T. baccata adpressa.**—One of the most distinct of the many varieties, the broad and short leaves rendering recognition by no means difficult. It is of spreading growth, with short, sub-horizontal branches, and very dark green leaves, arranged in double rows, and inclined upwards and forwards. Each leaf is about ½ an inch long, and obtusely pointed, while the fruit is vermilion red, the cup usually only half covering the ovoid seed. By many authors this has been described as a species, but, although very distinct both in leaves and fruit, yet the fact of certain specimens that have come under my own notice containing both branches of the species and *T. b. adpressa*, clearly proves the parentage.

In reply to a letter of mine, the late Mr. F. Arthur Dickson, of the Chester Nurseries, writes as follows regarding the present shrub:—"This yew was discovered by my father, the late Mr. Francis Dickson, somewhere about 1838. It was growing in a bed of seedlings of the common English yew. It is therefore undoubtedly a seedling sport. Being of slow growth, it was necessarily slow of propagation, and it took many years to get up a stock upon the grounds of the then firm of F. & J. Dickson, of which my father was the head. I well remember the value my father set by this plant, and his chagrin and vexation when, on his return home after a few days' absence, he learned that a representative of the late firm of Knight & Perry, nurserymen, Chelsea, had, in looking over the nurseries, purchased and taken away with him some half-dozen good-sized plants, as the result of negotiation with an inexperienced salesman, who was presumably ignorant of the value of the plants. This enabled the Chelsea firm to

propagate the plant, and, if I remember rightly, the specific name "adpressa' was given to it by Knight & Perry, but my father always adhered to the name he had originally given it—'brevifolia.'" In order to avoid confusion, I have retained the name by which this distinct variety is commonly known.

**T. baccata adpressa erecta** differs from the preceding only in being of partially erect growth.

**T. baccata adpressa variegata** is a valuable variety, in which many of the branch tips are of a silvery-golden tint.

**T. baccata aurea** is one of the most striking of the many varieties, it being always bright, brilliant, and effective. The leaves for the greater part are of a bright golden-yellow, and especially so during the growing season. It is of free growth, and admirably suited for planting in clumps in front of darker foliaged subjects.

**T. baccata Cheshuntensis** is of partially upright growth, with small, closely-arranged leaves, that are dark green above, glaucescent beneath, and long-pointed. It is a graceful variety, of strict but informal growth, and was raised from seed of the Irish yew.

**T. baccata Dovastonii.**—This is a remarkable creeping variety, the branches being long and partially horizontal, and the branchlets gracefully drooping. The leaves are relatively larger, more curved, and of a deeper shade of green than those of the species. *T. baccata Dovastonii aurea variegata* is well described by the name.

**T. baccata elegantissima** is of dense, upright growth, with whitish or pale yellow thickly produced leaves. The neat habit and constant variegation render it a desirable and ornamental variety.

**T. baccata erecta.**—A not very elegant variety, having erect-growing slender branches and small glossy green leaves, arranged for the greater part in two rows.

**T. baccata ericoides** (empetrifolia) is of neat and small growth, the branches slender and close set, and the leaves very small and closely arranged. The reddish bark of

the branches showing here and there through the deep green foliage has a pleasing effect.

**T. baccata fastigiata** is a well-known and justly popular variety that originated in Ireland—hence the popular name, Irish yew, that has been bestowed upon it. The habit is strictly fastigiate, the branches short, stout, and close-growing, and the leaves of a deep green, and scattered around the branchlets.

**T. baccata fastigiata argentea** differs principally in the yellowish-white tint of the younger branch tips and some of the leaves, but owing to its inconstant variegation has not been largely planted.

**T. baccata fastigiata aurea** is a very desirable variety, in which many of the leaves are margined with golden-yellow, or the young shoots wholly suffused with the same colour. It is a useful and desirable variety.

**T. baccata fructo-luteo** (Yellow-berried Yew) is at once remarkable for the berries being yellow instead of red, as in the species. It is a very ornamental variety, with divaricated branches, and rather short, sharp-pointed leaves, which are usually more or less curved. Being of vigorous growth, with pleasing green foliage and bright yellow fruit, this variety is worthy of extended culture.

**T. baccata Jacksonii** is an interesting variety with curiously twisted leaves, which are altogether smaller than those of the species. It is of weeping habit, and forms a neat small-growing shrub with distinct light green foliage.

**T. baccata nana,** as the name denotes, is of dwarf growth. The habit is compact and upright, dense of growth, and the foliage comparatively smaller and darker in colour than that of the species. It is a useful shrub for many positions, and though rarely rising more than a yard from the ground, has a wide spread in proportion to the height.

**T. baccata Nidpathensis.**—This variety, as usually seen, is of columnar habit, with an inclination to become spreading at the head. The leaves are small, closely arranged, and of a bright and glossy green.

**T. baccata nigra** is remarkable for the dark green of the upper, and bluish-green of the under sides of the leaves, the latter particularly rendering the shrub unusual amongst the numerous varieties of the yew. It is of bold and rather upright growth, and has a decidedly ornamental though somewhat sombre appearance when viewed from the distance.

**T. baccata procumbens** spreads to a wide extent, and is useful for covering bare or rocky ground. The foliage is bright green, and the bark usually of a dull cinnamon colour.

**T. baccata Washingtonia** has the foliage diffused with a bright bronzy-gold tinge, which makes full-grown specimens very distinct and attractive. It is of free growth, and succeeds best when fully exposed to both wind and sun.

**T. brevifolia,** Nuttall. (*Synonyms:—T. Bourserii*, Carrière; *T. Lindleyana*, Murray; *T. baccata canadensis*, Bentham.) North-West America, British Columbia, to California. 1854.—A very distinct species with foliage shorter, lighter in colour, and more feathery than that of our native species. The leaves vary much in length, but are usually about $\frac{3}{4}$ of an inch, stout, and rounded at the apex. In this country *T. brevifolia* takes the form of a spreading bush, the lower branches ramifying and extending to a distance disproportionate to the height. The branches are thinly produced when compared with those of our common yew, and this, with the shorter leaves and yellowish-green colour, render the tree by no means difficult to recognise. It should not be confused with the short-leaved variety of *T. baccata*.

**T. canadensis,** Willdenow. (*Synonym:—T. baccata canadensis*, Gray.) Canada and North-Eastern States of America. About 1800.—A low-growing and far-spreading species, with smaller and lighter coloured foliage, and bearing berries that are of much less size than those of our native species. It is rare in cultivation.

**T. cuspidata,** Siebold and Zuccarini. Mountains of Japan.—An uncommon species, that is at once distinguished by its irregular and open outline, and broad, leathery leaves. It is of no special value for ornamental planting.

**THUYA** (Linnæus)—including Biota and Thuyopsis.

THE ARBORVITÆS.

*Flowers* monœcious; male catkins oval; females solitary and terminal.

*Cones* small, oblong or globular; scales thickened upwards, valvate, and from six to ten in number.

*Seeds* usually winged, in twos at the base of the lowermost or middle pair of scales.

*Cotyledons* two.

Evergreen trees or shrubs, with appressed leaves and usually oblong cones. The seeds are winged on both sides, unless in the old genus Biota, in which this appendage is quite wanting.

**Thuya dolabrata,** Linnæus. (*Synonym:—Thuyopsis dolabrata*, Siebold and Zuccarini.) Mountains of Japan. 1853. —For ornamental planting this conifer holds an important place, its distinctive characteristics and the readiness with which it may be cultivated being generally recognised. In this country it forms a handsome conical specimen, with vertical branches and drooping branchlets, the latter numerous and much compressed. The leaves are flat and scale-like, regularly imbricated, of a rich, shining, green above, and silvery beneath. The cones are sub-globose, and nearly $\frac{3}{4}$ of an inch in diameter. It prefers rich moist loam or peaty soil, and does not object to grow where shaded and hemmed in by taller-growing trees. Shelter from cold winds is imperative.

**T. dolabrata nana** (*Synonym:—Thuyopsis lætevirens*, Lindley). The Dwarf Japanese Thuya.—This is a slow-growing, miniature bush, with comparatively small light green foliage, more resembling a lycopod than a conifer. The average height of a large number of old specimens that I examined was only about 20 inches, while the spread of the branches was nearly 3 feet. All are remarkable for their tidy and uniform habit of growth, forming

dense, compact specimens, yet not stiffly so, as is the case with many pigmy conifers. The affinity between the species and this variety is readily recognised, but the foliage of the latter is altogether thinner, and more flaccid, and of a much lighter and more silvery-green than that of the parent. It is a useful shrub for the rock-work or confined border, and the silvery-tinted foliage makes the plant remarkable and pleasing.

**T. dolabrata variegata** is a praiseworthy variety, and one that in point of vigour of growth surpasses the parent, while at the same time it is far less inclined to form a multiplicity of leading shoots. It is of upright growth, the branches regularly arranged, and the branch tips clearly and distinctly marked with a rich golden-yellow.

**T. gigantea,** Nuttall. The Giant Arborvitæ.[1] (*Synonyms:—Thuya Lobbi* of gardens; *T. Menziesii,* Carrière; *T. Craigiana* of gardens.) Alaska to California, and Western slopes of Montana. 1851.—A handsome and useful timber tree in this country, and one that is perfectly hardy everywhere, and of the freest growth. The quality of timber produced in England warrants us in speaking highly of this conifer for afforesting purposes, it being light, firm, and of good lasting quality; but it is well to remember that many worthless slow-growing forms of the tree have of late years crept into circulation. The tree, too, is very non-exacting as to the quality of soil in which it is planted, and also succeeds well on exposed ground. As an ornamental tree it likewise deserves attention, the free growth and distinct shade of green which pervades the foliage lending to it a peculiarly distinct and pleasing appearance. The trunk is straight and of gradual taper, the branches evenly distributed, long and lithe, and the branchlets numerous and thickly supplied with dark green foliage. The cones are small, about $\frac{3}{4}$ of an inch long, oval in shape, and generally produced plentifully on the upper sides of the branches, where they stand almost erect. Usually the

[1] A monograph on *The Giant Arborvitæ*, by the present writer, will be found in the "Transactions of the Royal Scottish Arboricultural Society," vol. xii., part ii., 1889.

spread of branches is narrow in proportion to the height of the tree, while the long annual growth causes these to be placed far apart on the stem. There are two varieties, *T. gigantea compacta*, and *T. gigantea pendula.*

**T. japonica,** Maximowicz. (*Synonyms:—Thuya Standishii*, Carrière; *Thuyopsis Standishii*, Gordon; *Thuya gigantea japonica*, Parlatore.) Mountains of Japan. 1861.—This, in general appearance, resembles the common arborvitæ, but is of much greater value as a decorative tree. It is of free growth, less thickly branched than the American species, with stouter and more pendulous branchlets, which are flattened at the ends, and gracefully drooping. In winter the foliage turns from the pale yellowish-green of summer to a distinct bronzy tint, which is very pleasing and effective. With this species there is far less difficulty in getting a leader than is the case with many of the Thuyas.

**T. occidentalis,** Linnæus. Common or American Arborvitæ. Canada, the New England and Middle States. Prior to 1597.—A commonly cultivated and perfectly hardy shrubbery species, but one that is of little value for ornamental planting. It is usually of irregular growth, but inclined to be pyramidal, with stout branches scattered over the trunk, the branchlets partly drooping, and well clothed towards the extremities in particular with the parti-coloured foliage, which is brownish-green during the growing season, changing to brownish-purple in winter. The following are the most distinct varieties.

**T. occidentalis argentea** is of neat, dwarf growth, and perfectly distinct from every other that I have met with. The foliage is of a deeper green than the species, many of the branch tips being tipped with white. It is very hardy and attractive.

**T. occidentalis aurea** is a beautiful and distinct variety of one of the hardiest of all conifers. It grows robust and strong, with an upright inclination, the foliage being prettily suffused by rich golden-yellow, changing in winter to a golden-bronzy hue. It is a desirable form of ready culture, and quite constant.

**T. occidentalis Ellwangeriana** is one of the neatest of the many varieties of the American arborvitæ, it being fairly dwarf, dense, and sub-erect of growth. The branches are pendulous and slender, while the foliage is either scale-like or linear, and sharp-pointed.

**T. occidentalis Hoveii.**—This well merits attention, being of dwarf, neat growth, with thickly arranged, brightly tinted foliage.

**T. occidentalis lutea.**—Though at certain seasons of the year the present variety bears great resemblance to *T. occidentalis Vervaeneana*, yet when the two varieties are growing in close proximity, and thus of ready comparison, the differences are readily ascertained. The variety lutea forms a more upright growing and densely-branched specimen than Vervaeneana, while the young shoots are of a bright orange colour as compared with the greenish-yellow of Vervaeneana.

**T, occidentalis pendula** differs much in habit in several specimens, the usually recognised form having the branches recurved and the slender branchlets thickly arranged near the branch extremities. The best form is distinct and valuable.

**T. occidentalis Vervaeneana** well merits attention, the slender branches being of a deep and decided golden-green, darkening during early winter to a golden-brown. The habit is very neat and erect.

**T. occidentalis Wareana.**—This is of dense, neat habit, with horizontal branches, and remarkable for the deep green of the foliage. It is decidedly preferable for ornamental planting to the parent, being more regular of growth, of deeper foliage tint, and with the branchlets clustered and compact at the branch ends.

**T, orientalis,** Linnæus. Chinese Arborvitæ. (*Synonym:—Biota orientalis*, Endlicher.) China, Japan.—A well-known and valued species with brighter green foliage and denser habit than *T. occidentalis*. As usually seen in this country, it is of dense columnar appearance, both the branches and branchlets being of decidedly upright growth, and the

latter well supplied with scale-like imbricated leaves, arranged in four rows. Cones ½ an inch long, composed of six scales, and of a dull brown when ripe. There are many forms, the following including the most distinct.

**T. orientalis aurea** is one of the most distinct and popular of the many varieties, and is often met with under the specific name of *T. aurea*. It forms a dense globular bush, the growing foliage being golden-yellow, this subsiding into a dull green with age and on the approach of winter.

**T. orientalis densa glauca.**—Whether for its neat habit or pleasing colour, this dwarf conifer will well merit attention; while it is quite distinct from any of the numerous small growing forms of the Chinese arborvitæ. The usual habit is a dense conical mass of rather feeble branches, the foliage of the most pleasing glaucous-green shade—a colour that is constant at all seasons of the year. Being of seedling growth, this marked characteristic is retained under cultivation.

**T. orientalis elegantissima** is of narrow pyramidal habit of growth, the foliage being of a constant golden-green. It is more stiff in outline than *T. orientalis aurea*.

**T. orientalis ericoides** (*Synonym:—Retinispora ericoides*) is one of the neatest and dwarfest of the tribe, it being usually seen as a dense, compact shrub of not greatly over 1 yard in height. The change in colour of foliage from a light, clear green in summer to a bronzy-violet in winter, is both curious and beautiful. Both branches and branchlets are slender and numerous, while the primordial foliage is arranged in pairs, and distinctly glaucous beneath.

**T. orientalis falcata** has a rather irregular habit of growth, though of dense somewhat conical outline, and is well-furnished with brownish-green foliage. It is rendered curiously distinct by reason of the cone-scales terminating in sickle-like spines. Each cone is ¾ of an inch long, and composed of six scales and six wingless seeds.

**T. orientalis falcata lutea** (Webster) is of neat, pyramidal habit, with comparatively short and slender branches, the colour of foliage being a rich, subdued yellow, which not only extends to the leaves in every part, but to the bark of the branches as well. The cones are fully an inch long, and rendered strangely conspicuous by reason of the long appendage to each of the scales. The latter resemble nothing so much as the fangs of a tooth. This is a worthy variety, and for its neat habit, distinct colour, and curious cones, is well worthy of culture.

**T. orientalis Meldensis.**—This is a stage of growth in which the leaves are subulate, never scale-like as in the species. It has no particular right to be included as an ornamental variety, the outline being irregular from the thin pliable branches bending about in many directions, though with an inclination towards the stem. The foliage is bluish-green in summer, but assumes a bronzy tint with the approach of winter.

**T. orientalis pendula.** (*Synonym:—T. pendula* of gardens.)—Amongst pendulous-habited conifers this is certainly one of the most distinct and attractive, while at the same time it is perhaps the most fastidious in its requirements. It is very apt when growing under unfavourable conditions to lose the lower branches, and in consequence it wears a naked and miserable appearance; but when seen in a healthy, thriving state it must certainly be ranked as one of the most pleasing and ornamental of hardy conifers. It differs much from the species, the flattened, freely divided branches being replaced by long, pendulous, cord-like branches, with but few ramifications. Planted singly and in suitable soil, it forms an ornamental, small-growing tree of regular outline; while the long, filiform branchlets impart a grace and elegance to the specimen for which it is justly remarkable. The largest specimen I have seen is growing in deep, dampish, sandy soil at Esher Place, in Surrey, it being 16 feet high, 12 feet through, and with many of the branchlets hanging gracefully downwards for 18 inches in length. From this specimen I have

picked fruit similar in every respect to that of *T. orientalis*, this proving conclusively that it is only a distinct and well-marked variety, and not a species as was at one time supposed.

**T. orientalis semperaurescens.**—This is a neat and dwarf bush, and which at no time loses its golden tinge, the bright hue of the foliage rendering it conspicuous and cheery even in the depth of the winter season.

**T. orientalis Zuccariniana.**—Amongst small-growing, neat-habited, and bright-foliaged shrubby, or rather pigmy conifers, this is one of the best, and there are many purposes to which it may be applied, especially in grounds of limited extent. The branches are numerous and slender, forming a dense, globose mass, and thickly-furnished with bright green foliage, which colour it retains throughout the year. It is a cheerful, pleasing shade of green, for which the plant is justly remarkable; and this, coupled with the neat outline and ease of culture and propagation, should tend to its increased cultivation.

**T. plicata,** Don. (*Synonyms:*—*T. occidentalis plicata*, Loudon; *T. Wareana*, Booth; *T. gigantea plicata*, R. Brown.) North-West America. 1796.—In this we have a small-growing tree of neat outline, but greatly resembling the American arborvitæ, from which, however, it may readily be distinguished by the shorter branches and less straggling habit of growth. The branchlets being numerous, give to the tree, although the main branches are usually placed far apart, a well-furnished and neat outline, and these in turn are furnished with pairs of closely-appressed leaves, that are brownish-green in colour. The cones are $\frac{3}{8}$ of an inch long, with six scales, and three of four seeds towards the middle. A particular value must be attached to this species, from its thriving well in cold and draughty situations where many conifers could not succeed. Though sometimes placed as a variety of *T. gigantea* and *T. occidentalis*, yet for garden purposes *T. plicata* is amply distinct, whether in habit, foliage, or fruit.

**T. plicata cristata.**—A dwarf, curious variety, with the

branches much sub-divided at their extremities, thus causing a tufted or crested appearance, some of these ball-shaped crested masses being 3 inches in diameter. It is very interesting and pleasing of growth.

## TORREYA (Arnott).

### THE FETID YEWS.

*Flowers* diœcious; males solitary; females in twos or threes.

*Fruit* drupaceous, one-seeded, fleshy on the outside, and about the size of a nutmeg.

*Seed* solitary in each fruit; albumen ruminate.

*Leaves* two-ranked, linear, and decurrent at the base.

*Cotyledons* two.

Small evergreen trees or shrubs, with two-ranked leaves and drupacious fruit like a nutmeg. Both leaves and fruit emit an unpleasant odour when bruised.

**Torreya californica,** Torrey. (*Synonym:—T. myristica*, Hooker). California. 1851.—This is a beautiful species, that flourishes well in many parts of the country, but the finest specimens I have seen are growing in the mild, humid atmosphere of several parts of Ireland. In this country it forms a well-branched sturdy bush or small tree, with an inclination to form long and somewhat irregular lower branches, which it is well to keep in check by judicious pruning, an operation that it by no means resents. The foliage is of a fresh and distinct shade of green, each leaf being $2\frac{1}{2}$ inches long, flat, sharp-pointed, and with a sunken line on each side of the indistinct midrib. When bruised, the leaves emit a peculiar, not pleasant odour. The fruit, which is fleshy on the outside, like our common plum, and elliptic in shape, averages fully $1\frac{1}{2}$ inches long, and contains a nutmeg-like seed covered with a hard, bony shell. When seen in full fruit the contrast between the long green leaves and curious plum-like fruit is remarkable. The soil that would seem to suit this

species best is that mainly composed of peat, and where the situation is well sheltered.[1]

**T. grandis,** Fortune. Northern China. 1847.—From the latter species this is readily distinguished by the shorter leaves and smaller fruit. It has not proved hardy in this country, although in more than one station I have been shown thriving plants, and a very fine specimen may be seen in the grounds at Churchill, County Armagh, Ireland. The outline of this specimen is neat but spreading, the branches flattened, and supplied with dark green leaves, each about 1 inch long, the under-side being rendered silvery by the two pale-coloured furrows which run for three-quarters the length of the leaf. The fruit is rounded, not elongated as in the latter species, and averages 1 inch in length.

**T. nucifera,** Siebold and Zuccarini. Japan. 1818.—Unless under very favourable conditions, this species is rarely found as a thriving specimen in these isles. When seen at its best it is of neat, compact growth, with spreading branches and numerous branchlets, that are well furnished with yew-green foliage, each leaf being about 1 inch long. The fruit is about the same length as the leaves, and elliptic in shape.

**T. taxifolia,** Arnott. Western Florida. 1838.—Like the latter species, this cannot be depended upon in point of hardihood. Unless in the very warmest parts of the country, and under unusually favourable conditions, healthy specimens are rarely to be met with. It is of remarkably slow growth, and seldom makes a neat plant. The leaves are pale shining green in colour, stiff, sharp-pointed, and fully 1 inch long, while the fruit is egg-shaped, and 1 inch long. The branches have a yellowish appearance, owing to the colour of certain portions of the bark.

[1] One of the largest specimens I know of is growing, with many other rare conifers, at Orton Longueville, in Huntingdonshire. It is about 20 feet high, and has borne fruit in abundance.

## TSUGA (Carrière).

THE HEMLOCK SPRUCES.

*Flowers* monœcious ; males lateral ; females terminal.

*Cones* terminal, pendent, almost spheroid, with persistent scales.

*Seeds* small, with obovate wing.

*Leaves* linear, flat, stalked, and proceeding from prominent cushions.

*Cotyledons* varying from three to six.

Evergreen trees or shrubs of great value for ornamental planting.

**Tsuga Brunoniana,** Carrièri. (*Synonyms:—Pinus dumosa,* Don; *Pinus Brunoniana,* Wallich; *Abies Brunoniana,* Lindley; *Abies dumosa,* Loudon; *A. cedroides,* Griffs.) Eastern and Central Himalayas. 1838.—This may rightly be described as the handsomest of the genus, though, unfortunately, it is not generally hardy. When seen in a thriving condition it forms a round-headed pyramid, the branches and branchlets gracefully drooping towards the points, and thickly furnished with leaves that are longer than those of any other member of the family, and of an intense silvery hue underneath. Each leaf is about 1 inch long, flat, and serrulated, particularly towards the point. The cones are produced singly at the branch tips, and are almost similar in size and shape to those of the better known *T. canadensis.* Being apt to suffer from frost after having started into growth in spring, this tree should always be planted in a position where vegetation generally is late in commencing growth. Winter frosts have little effect upon the tree; it is the immature shoots of last season or the present that suffer most. The rate of growth under favourable circumstances is nearly 1 foot per year. One specimen that I measured had attained to the height of 20 feet in nineteen years, and produced cones regularly.

**T. canadensis,** Carrière. The Hemlock Spruce.

(*Synonyms:—Pinus canadensis*, Linnæus; *Abies canadensis* Desfontaines; *Picea canadensis*, Link; *Abies curvifolia*, Salisbury.) North-East America. 1736.—This is the best known species, and is particularly suitable for cultivation in this country. It is of pyramidal habit until about half its height is attained, after which the top gradually assumes a flat or rounded form, the branches become more open, and the branchlets decidedly pendulous. The leaves are of a pleasant green above, $\frac{1}{2}$ an inch long, silvery beneath, and thickly produced. Cones are borne in great profusion at the branch tips, each being about 1 inch long, and composed of about twenty-five brownish, broadly wedge-shaped scales. Few evergreen trees can surpass the hemlock spruce for beauty and richness of foliage, or distinct and pleasing outline; and during spring and early summer the young drooping shoots, of a lively yellowish-green, contrast nicely with the dark and sombre hue of the older foliage, and form a combination that for beauty of effect is certainly hard to match. The soil best suited for the growth of the tree is rather strong, damp loam; indeed, some of the finest trees that I have seen are growing by a lake-side, and where the roots must be partially submerged at all seasons.

**T. canadensis aurea** is, judging from the few specimens that I have had the opportunity of examining, no great acquisition, the colouring being both irregular and inconstant. In the juvenile state it is preferable to more advanced years.

**T. canadensis globularis erecta** is of dwarf, spreading appearance, with thick, closely arranged branches, that are at first erect, but afterwards gracefully drooping. The leaves are closely arranged, smaller and narrower than those of the species, and of a much lighter green colour. It is of continental origin.

**T. canadensis macrophylla.**—Both in colour of foliage and habit of growth this is totally different from the parent. The habit is dwarf, the outline regular, but not stiffly so, and the compact masses of foliage are of the darkest and most decided shade of green, and greatly intensified by their

shining lustre, which is at all times both pronounced and pleasing. The leaves are comparatively broader than those of the species, but it is their dark shining green tint that offers such a contrast to the greyish-green of the parent, and which, without the dwarf habit, would at once render simple the recognition of this valuable variety. It is certainly one of the most desirable of small-growing conifers, but requiring to be layered or grafted in order to fully perpetuate its distinctive characteristics, has long kept it in the background.

**T. canadensis nana** is of very dwarf and spreading growth, with short branches and closely-set tufted leaves. The specimens I have seen were 27 inches high, and fully 3 feet across.

**T. canadensis parvifolia** is a very distinct variety that at once attracts attention by the small and deep green leaves. They are usually $\frac{1}{4}$ of an inch long, quickly pointed, and appressed to the branches, these latter being lithe and slender.

**T. canadensis pendula.** Weeping Hemlock Spruce. —This is a tree of great beauty, but, unfortunately it is rarely met with. In no way does it differ from the commonly cultivated tree, save in the long, weeping spray, the branch tips one and all hanging gracefully downwards for in most instances a couple of feet in length. The finest specimen that I have seen is growing by the lake-side at Hollydale, the Earl of Derby's Kentish property. It is fully 20 feet high, and has borne cones abundantly.

**T. caroliniana,** Green. Mountains of North and South Carolina. 1881.—This nearly approaches *T. canadensis*, but from that species may at once be distinguished by its much longer, blunter-pointed, and glossier foliage. The cones are proportionally large, with wide, spreading scales of a dark brown colour. It is a beautiful little tree, of neat habit, and slow growth, and succeeds well when planted in rich loamy peat, and where not exposed to cold or cutting winds.

**T. mertensiana,** Carrière. Western Hemlock. (*Synonyms:—Pinus Mertensiana*, Bongard; *Abies Mertensiana*,

Lindley; *A. Albertiana*, Murray.) Alaska, British Columbia, Oregon. 1851.—Both as an ornamental tree and for its rapid growth, this species can well hold its own with any other that has yet been introduced. It is of erect growth with a stout, leading shoot, that usually keeps well ahead of the surrounding branches, the latter being long, lithe, and of irregular lengths, while the branchlets are distinctly pendulous and feathery. The foliage is two-ranked, and spreading horizontally, or nearly so, each leaf $\frac{1}{2}$ an inch long, and of a dark shade of green. Cones are plentifully produced in this country, they resembling those of *T. canadensis*, but having more elongated scales and longer wings to the seeds.

The tree, when favourably situated, is of rapid upward growth, the average of fifteen specimens that I measured being 15 inches per year. By far the finest specimen that I have measured is growing amongst the Welsh hills at Hafodunos, and which produced in thirty-five years 48½ feet of wood, or fully 1⅓ feet per annum. I have experimented with the timber of twenty-five years' growth, and though it is hard, not heavy, and of a pleasing light brown colour, yet the lasting properties were not remarkable, but the partial immaturity of the wood would to some extent account for this. This species is worthy of trial for afforesting purposes.

**T. Pattoniana,** Engelmann. (*Synonyms:—Abies Pattoniana*, Jeffrey; *A. Hookeriana*, Murray; *A. Williamsonii*, Newberry; *Pinus Pattoniana*, Parlatore.) Fraser River to South California.—A distinct and ornamental small-growing tree that is at once distinguished from any other species by the nearly erect thickly scattered leaves, which are not two-ranked and horizontally arranged as in most species. Each leaf is $\frac{5}{8}$ of an inch long, and either keeled and convex or furrowed in the centre. The cones are about 2 inches long, cylindrical-oblong, the scales becoming reflexed when quite ripe or after the cones have fallen from the tree; while the beautiful lilac catkins are produced in such quantities as to render the tree very conspicuous during early spring.

In this country *T. Pattoniana* is of slow growth, but neat and

compact, and the foliage of a beautiful bluish-green tinge. The tree usually seen under the name of *T. Hookeriana* (supposed by some botanists to be a distinct species, and by others to be a variety) seems distinct from *T. Pattoniana*, the leaves being shorter, narrower, generally curved, irregularly arranged, and fresh green above and silvery beneath, but they vary.

**T. Sieboldi,** Carrière. (*Synonyms:—Pinus Tsuga*, Antoine; *Abies Tsuga*, Siebold and Zuccarini; *Tsuga diversifolia* Maximowicz.) Japan. 1853.—This is of neat and elegant habit, slow of growth, and valuable for planting where space is rather confined. At a distance the present species bears a striking resemblance to the Canadian Hemlock, but on close examination the Japanese species will be found to have stouter, broader, and longer leaves, many being notched at the point, and with a deeper green upper and more silvery under-surface. The cones are abundantly distinct, being nearly circular, 1 inch in diameter, and the scales rounded. It is of dense growth, spreading out widely on all sides, and would appear to thrive on much lighter soils than other members of the same genus.

**T. Sieboldi nana** is of dwarf, neat, and graceful growth, rarely growing to more than 4 feet in height, and with small and thickly-produced foliage, that is both bright and effective. Being of small, compact growth, and with beautiful silvery foliage, there are many places suitable for the growth of this dwarf form.

## CHAPTER II.

### PROPAGATING CONIFERS.

CONIFERS are usually propagated or increased by one of four different methods—seed-sowing, grafting, layering, or the insertion of cuttings. Seed-sowing is to be recommended, but when seed is difficult to obtain, as is not unfrequently the case with many conifers, propagating from cuttings, by layers or grafting, is usually resorted to.

**From seed.**—Seedling conifers may either be raised in pots or boxes placed in a close frame, or in the open border. The former method is, however, to be recommended, as they can then more readily be protected from heavy rains, sudden changes of atmosphere, or the depredations of rats, mice, and birds. With the rarer conifers, and when seeds are very limited in quantity, pot sowing is to be preferred; but when large numbers are to be raised, sowing either directly in the frame or in shallow boxes placed therein will be found the most convenient. Spring or early summer is the best time to sow seeds of coniferous trees. The pots, pans, or boxes should be clean, thoroughly drained, and filled three-fourths their depth with a mixture of loam, leaf-mould, and silver sand. Well press down the soil, thoroughly water, and sow on the following day. In sowing spread the seeds evenly and not too thickly over the prepared surface, and cover with light sandy soil, avoiding too deep covering, otherwise the seedling plants would fail to penetrate the soil, and in consequence many would fail to germinate.

A slight watering should then be given, and the frame closed down, and when the seed-bed is not exposed to after-currents of air and sunshine, subsequent heavy waterings will not be required. Probably the most critical period in connection with the raising of seedling conifers is the time that they are pushing

through the ground surface, and any indiscretion in the way of shading or watering at that point of culture usually proves disastrous. Keeping the surface rather dry than otherwise is, however, to be recommended. A free current of air may be admitted after the seedlings are well through the ground; and in two years after germination they may either be pricked out in the open border, in pans or boxes, or potted singly. With such hardy, free-growing conifers as the larch, spruce, silver fir, Scotch and Corsican pines, the seeds should be sown in well prepared beds of light, free soil out of doors. The seed-beds may be 4 feet wide, and the soil rendered light and free if necessary, the covering to be proportionate to the size of the seed. Branches of spruce fir laid over the beds are useful as guards against excessive sunshine and the depredations of birds.

The following table will show at a glance the approximate and relative number of seeds contained in 1 lb. weight of each of the following species :—

| Name of Tree. | Number of Seeds contained in 1 lb. weight. |
|---|---|
| Abies amabilis, | 5,400 |
| „ balsamea, | 71,100 |
| „ brachyphylla, | 52,500 |
| „ cephalonica, | 9,000 |
| „ grandis, | 23,500 |
| „ nobilis, | 19,400 |
| „ Nordmanniana, | 9,900 |
| „ pectinata, | 14,900 |
| „ Pinsapo, | 10,800 |
| „ Veitchii, | 52,500 |
| Cedrus atlantica, | 7,600 |
| „ Deodara, | 9,900 |
| „ Libani, | 10,800 |
| Cephalotaxus pedunculata, | 893 |
| Cupressus Lawsoniana, | 105,000 |
| „ nootkatensis, | 112,000 |
| „ obtusa, | 280,000 |
| Cryptomeria japonica, | 182,400 |
| Juniperus excelsa, | 1,800 |
| „ sabina, | 2,200 |
| „ virginiana, | 22,000 |

| Name of Tree. | Number of Seeds contained in 1 lb. weight. |
|---|---|
| Juniperus vulgaris, | 7,200 |
| Larix europæa, | 68,000 |
| Picea Ajanensis, | 350,000 |
| „ alba, | 154,500 |
| „ excelsa, | 68,800 |
| „ sitchensis, | 453,300 |
| „ morinda, | 24,900 |
| „ orientalis, | 72,500 |
| „ obovate, | 40,800 |
| Pinus Cembra, | 2,592 |
| „ Coulteri, | 1,360 |
| „ excelsa, | 10,800 |
| „ insignis, | 19,900 |
| „ Lambertiana, | 2,000 |
| „ Laricio, | 41,200 |
| „ patula, | 46,660 |
| „ Peuce, | 12,200 |
| „ Pinea, | 520 |
| „ ponderosa, | 9,900 |
| „ rigida, | 82,000 |
| „ sabiniana, | 480 |
| „ Strobus, | 31,700 |
| „ silvestris, | 90,600 |
| Pseudotsuga Douglasii, | 95,200 |
| Salisburia adiantifolia, | 270 |
| Sequoia gigantea, | 143,800 |
| „ gigantea pendula, | 113,000 |
| Taxodium distichum, | 8,600 |
| Taxus baccata, | 6,125 |
| „ baccata adpressa, | 7,546 |
| „ baccata fastigiata, | 5,444 |
| Thuya gigantea, | 93,330 |
| „ occidentalis, | 186,600 |
| „ orientalis, | 31,500 |
| „ orientalis falcata, | 35,000 |
| „ plicata, | 245,000 |
| Tsuga canadensis, | 210,000 |

It should be stated that the weights of many coniferous tree seeds vary greatly according to the age of the specimen and situation in which it is growing. In compiling the above table, three lots of seeds of several species, collected from different trees, were weighed, and the averages are recorded. Newly collected seeds were invariably used in compiling the table.

**From cuttings.**—An objection to the raising of certain species, at least of coniferous trees from cuttings, is that they are tardy to produce leading shoots, many naturally upright-habited trees when propagated in this way assuming a creeping habit of growth, and with little or no inclination to start away freely with a single leader. Small-growing conifers, such as the various forms of Cupressus, Juniperus, Thuya, and Taxus, are, however, readily increased by inserting cuttings in previously prepared soil about the end of August. The cuttings, of rare species at least, are usually inserted in pots or boxes of suitable soil, while such as are hardier and more readily procured strike root freely enough when placed in the open border, preferably a sheltered spot under a north wall. Thorough preparation of the soil in which the cuttings are to be inserted is a point of consideration, and this should be composed of nearly equal proportions of peat, loam, and sharp sand thoroughly consolidated. The choice of cuttings is an equally important point, these being always taken from the outer and exposed branches, those from the interior and shady portions being avoided as difficult to strike, and apt to damp off, this also applying to the succulent portions of the leading shoots and branch tips. The cuttings may be from 4 inches to 6 inches long, should be of the current season's growth, and with a "heel" or shoulder of old wood at the base. In preparing the cutting for inserting in the ground, the lower 2 inches should be made clean of leaves (unless such as are scale-like) or shoots by means of a sharp knife, stripping off the leaves by the fingers being decidedly objectionable. Place the cuttings about 3 inches deep in the prepared soil, making this quite firm around them, sprinkle a little silver sand over the surface, and moisten lightly. In raising trees from cuttings two points should be borne in mind, first to insert early enough so that the cuttings may be callused over before the winter; and second, to prevent direct sunshine from striking on them when forming roots in spring. These instructions are equally applicable to cuttings, whether placed in pots,

pans, or boxes in an unheated frame. The soil should be kept in a uniform state of moisture, and the lights tilted for an hour or two every morning to prevent too humid an atmosphere, and the cuttings from damping off.

**By grafting.**—Unless carefully performed on sound principles, conifer grafting is not to be recommended. The operation may be performed either early in spring or about the middle of August. Preferably the stock used for grafting on should be from two to three years old, as it is all important that both stock and scion be of nearly similar size. The stocks generally employed in grafting conifers are, for the Picea tribe, the Norway spruce (*P. excelsa*); for the Abies, the common silver fir (*A. pectinata*); for the Hemlock firs, *Tsuga canadensis;* and for the different Taxads, the common yew (*Taxus baccata*). For the Cypress tribe, *Cupressus Lawsoniana* is used; for the Thuyas, *Thuya orientalis* and *T. occidentalis;* and for the Junipers, *Juniperus communis.*

Usually the stocks are grown in 3-inch pots placed in a cool and nearly air-tight frame. There are several methods of grafting, but with most conifers ordinary side grafting is to be recommended. This consists in making a clean cut downwards in the stem for ¾ of an inch in length, a transverse cut being made at the termination thereof, and sufficient of the wood and bark removed to allow of the insertion of the graft. The scion should be prepared by cutting the end square across, and by shaving a piece from one of the sides of similar length to the cut in the stock—in fact, the scion should as nearly as possible replace the portion cut from the side of the stock. About 4 inches is a good length for the scion, which should, after being prepared as above directed, be tied securely in its place by grafting cotton, and this covered over either with clay or grafting wax. The frame containing the pots of grafted conifers should be kept close and shaded from too powerful light by mats or screening; but at the same time condensed moisture should be allowed to pass away by opening the lights for a short time in the morning.

In from a month to six weeks many of the grafts will have

taken, and after a complete union is effected the head of the stock may be gradually shortened back to the point where grafting took place. The graft should be placed low on the stock, or so as not to be noticeable above ground level.

**By layering.**—Several species of Picea and other conifers may be increased by layering the lower branches, but this system is rarely carried out. It consists in bending the branch down to ground level amongst previously prepared soil of a sandy, open nature, and where it is kept in position by means of a hooked peg until roots are emitted. After becoming rooted the branch is severed beyond the peg, or rather between the peg and the main stem, and the offshoot allowed to remain in the same position for another year, after which it may be carefully lifted, and either planted out permanently or transferred to the nursery border. Erect-growing plants are rarely obtained by layering.

## CHAPTER III.

### CONIFERS AND SOILS.

MANY, in fact most coniferous trees will thrive in any soil of fairly good quality, but it is likewise a well-known fact that certain species will only succeed satisfactorily when planted under peculiar conditions, whether as to soil or the amount of dampness that is present in the ground.

Thus *Sciadopitys verticillata* will only succeed when planted in dampish peaty ground, or decomposed leaf soil, while *Picea sitchensis* requires heavy retentive loam, it soon becoming unhealthy when planted in that of a light and dry nature. Again, *Abies Pinsapo* grows with unusual luxuriance when planted on chalk or limestone, and the same remark applies to *A. cephalonica* and *A. numidica*, both of which do better on chalk or limestone than they do in the loamy soils that are so well adapted for many other species of Abies. *P. Laricio austriaca* also succeeds best on chalky or calcareous soil.

*Pinus Pinaster*, *P. halepensis*, and *P. rigida* do best when planted on pure sand on the sea coast; whilst *P. silvestris* and *P. Laricio* grow nowhere with greater vigour or produce more valuable timber than when planted on rather poor or thin gravelly soils.

Again, *Taxodium distichum*, *Tsuga canadensis*, *Picea nigra*, *Cupressus macrocarpa*, *C. Thyoides*, and *Thuya occidentalis* will thrive where the roots are at times, or constantly submerged, and are therefore well suited for planting in damp or marshy ground. In the following lists the principal coniferous trees that have been found to succeed in the particular class of soil with which they are associated will be arranged in alphabetical order.

### CHALKY OR CALCAREOUS.

Abies amabilis
„ cephalonica
„ magnifica
„ nobilis
„ numidica
„ Pinsapo
Cedrus atlantica
„ Deodara
„ Libani
Cupressus Lawsoniana
„ macrocarpa
Ginkgo biloba
Juniperus communis
„ chinensis
„ Sabina
„ „ tamariscifolia
Larix europæa
„ Kæmpferi
„ leptolepis
Picea excelsa
Pinus Cembra
„ excelsa
„ Laricio
„ „ austriaca
„ Pinaster
„ Strobus
„ silvestris
„ tuberculata
Taxus baccata and varieties
Thuya gigantea
„ occidentalis.

### GRAVELLY AND SANDY.

Cupressus Lawsoniana
„ nootkatensis
Juniperus communis
„ Sabina
„ „ tamariscifolia
Pinus halepensis
„ Laricio
„ „ austriaca
Pinus Pinaster
„ rigida
„ tuberculata
„ silvestris
„ montana
Taxus baccata and several varieties
Thuya gigantea

### PEATY.

When planted in reclaimed peat bog many conifers grow with a luxuriance that is entirely wanting when they are seen under other conditions as regards soil. By far the largest and healthiest specimens of the rare and interesting *Pinus Bungeana*, *Cephalotaxus Fortunei*, and *C. drupacea*, *Fitzroya patagonica*, various species of *Podocarpus*, and *Torreya* that I have seen are growing in deep peat bog to which a quantity of road-scrapings were added at time of planting.

The larch does nowhere better or is more free from disease than when growing in peaty soil, while *Psuedotsuga Douglasii*, *Picea sitchensis* and *Abies Pichta*, as also *Cryptomeria japonica* and *Sequoia sempervirens* are all at home on deep peat bog. The following is a list of the most suitable :—

Abies bracteata
„ concolor
„ nobilis
„ Nordmanniana
Cedrus Deodara
Cryptomeria japonica
Cupressus Goveniana
„ Lawsoniana
„ and varieties.
„ macrocarpa
Juniperus chinensis
„ recurva
Larix europæa
„ Kæmpferi
Cephalotaxus drupacea
„ Fortunei
„ pedunculata
Fitzroya patagonica
Pinus excelsa
„ Bungeana
„ Laricio austriaca
„ pyrenaica
„ silvestris
Sequoia sempervirens
Taxus baccata
Thuya gigantea
„ occidentalis

## CLAYEY.

For planting in stiff, clayey soils I have found *Cryptomeria japonica* and its variety *elegans*, *Thuya gigantea* and *T. occidentalis*, to be by far the most useful ; while where ironstone or coal are present, nothing excels *Cupressus Lawsoniana*, *Juniperus communis*, *Larix europæa*, *Pinus Cembra*, and *P. montana*.

## CHAPTER IV.

### CONIFERS FOR VARIOUS POSITIONS.

**For Avenues.**—As avenue trees, several species of conifers have been widely recommended in books and catalogues, especially *Araucaria imbricata* and *Sequoia gigantea*, but that these two at least have sadly belied the hopes of the planter is now generally acknowledged, and a visit to Coombewood Nursery, to Woburn Park, and many other places throughout the country will bear out the statement. The avenue at Coombewood was composed of the *Araucaria* and *Sequoia* planted alternately, but the former trees have all been removed, while the latter look anything but promising; and at Woburn Abbey almost every *Araucaria* has been cut down. *Thuya gigantea* or *Abies brachyphylla* are much better suited, and several avenues that have recently been planted with these species will, no doubt, in years to come, give every satisfaction. In fairly sheltered situations *Cupresses Lawsoniana* and *Cedrus atlantica* make good avenue trees.

**For the Seaside.**—Many species of conifers do well in maritime situations, and particular notice should be taken of *Cupressus macrocarpa* and *C. nootkatensis*, *Pinus Pinaster*, *P. Pinaster maritima*, *P. Laricio*, *P. Laricio austriaca*, *P. halepensis*, *P. rigida*, *P. muricata*, *P. silvestris*, *Thuya gigantea*, and *T. orientalis*.

**For Exposed Situations.**—Nearly twenty years ago I formed a plantation for shelter-giving purposes on one of the spurs of the Snowdon range of hills, and amongst many

species of coniferous trees that were tried the following have done best :—*Pinus Laricio* and *P. Laricio austriaca, P. rigida, P. silvestris, P. montana, Thuya gigantea, Taxus baccata*, and *Juniperus communis.*

**For Smoky Localities.**—Few coniferous trees succeed well when planted in the smoke and fumes of our larger centres of industry. The best are *Thuya gigantea, Ginkgo biloba, Cupressus pisifera plumosa aurea, Taxus baccata, Cupressus Lawsoniana erecta viridis*, and *Cryptomeria japonica* with its variety *elegans.* These all do well in the impure atmosphere of two of our largest cities, but as we recede from these centres of death to tree and shrub life generally, many other species can be planted.

**For Confined Spaces.**—The list of coniferous trees that are of small and neat habit of growth, and, therefore, suitable for planting in small grounds, or where space is confined, is rather a long one, and would include, amongst others, the following :—

Cephalotaxus Fortunei
„ drupacea
Cryptomeria elegans
Cupressus Lawsoniana stricta
„ nootkatensis
„ obtusa
„ pisifera
„ Thyoides
Juniperus chinensis
„ „ aurea
„ communis
„ recurva
„ rigida
„ thurifera
„ virginiana
Picea Alcoquiana
„ Engelmanni
Picea Engelmanni glauca
„ orientalis
„ polita
Pinus Bungeana
„ Cembra
„ contorta
„ parviflora
Sciadopitys verticillata
Taxodium mucronatum
Taxus adpressa erecta
„ baccata fastigiata
Thuya dolabrata
„ „ variegata
„ occidentalis
„ orientalis
„ „ pendula
Torreya grandis

**For Hedge Purposes.**—Several species of conifers are well adapted for the formation of ornamental hedges, or for

garden divisions, but they should not generally be planted in positions to which farm stock have access. The following are to be recommended :—

Cupressus Lawsoniana
„ „ stricta
„ nootkatensis
Juniperus virginiana
Picea excelsa
Taxus baccata
Thuya gigantea
„ orientalis
„ occidentalis

In many parts of Scotland the common spruce (*Picea excelsa*) has been, and is, extensively employed in the formation of farm hedges or wind-screens, and for which purpose its free growth, perfect hardihood, and shelter-giving properties render it eminently adapted. Bearing pruning well, it can be cut into almost any desired shape, while topping is productive of greatly increased bottom growth and consequent shelter-affording qualities. The American Arborvitæ (*Thuya occidentalis*) succeeds satisfactorily as a hedge and screen shrub on several of the islands along the mainland of Scotland, and where it is highly valued as a hardy, storm-resisting, and free-growing tree.

## CHAPTER V.

### CONIFERS OF DIFFERENT CHARACTERISTICS.

**Weeping Conifers.**—When planted with discretion in suitable positions, many of the pendulous or weeping conifers are highly ornamental, and constitute a distinguishing feature of the park or grounds in which they are used. The following list includes some of the best:—

Cedrus Deodara
Cryptomeria elegans
Cupressus Lawsoniana
„ „ filifera
„ „ pendula
„ macrocarpa
„ nootkatensis pendula
Fitzroya patagonica
Juniperus chinensis
„ communis
„ excelsa
„ phœnicea
Juniperus recurva
„ virginiana
Larix pendula
Picea morinda
Taxodium distichum pendula
Taxus baccata pendula
Thuya occidentalis
„ „ pendula
„ orientalis pendula
Tsuga Brunoniana
„ canadensis
„ Mertensiana

### FASTIGIATE CONIFERS.

Cephalotaxus pedunculata fastigiata
Cupressus Lawsoniana erecta viridis
„ macrocarpa fastigiate
„ nootkatensis compacta
„ sempervirens
„ Thyoides
Cupressus torulosa
Juniperus communis hibernica
„ drupacea
„ excelsa stricta
„ thurifera
Pinus Cembra
Taxus baccata erecta
„ „ fastigiata
Thuya occidentalis Vervaeneana

### VARIEGATED CONIFERS.

Cedrus atlantica glauca
„ Libani argentea
Cupressus Lawsoniana alba spica
„ Lawsoniana alba-variegata.
„ Lawsoniana argentea
„ Lawsoniana argentea variegata
„ nootkatensis argentea variegata
„ nootkatensis aurea-variegata
„ pisifera plumosa aurea
„ pisifera plumosa argentea
Juniperus chinensis aurea
„ Sabina variegata
„ virginiana aurea
Larix Kæmpferi
Picea Engelmanni glauca
„ excelsa Finedonensis
Pinus silvestris aurea
„ ponderosa aurea
„ Massoniana aurea
Pseudotsuga Douglasii Stairii
Sequoia gigantea aurea
Taxus baccata aurea
„ „ elegantissima
„ „ fastigiata aurea
„ „ fastigiata argentea variegata
Taxus canadensis variegata
Thuya dolabrata variegata

### CONIFERS OF LOW-SPREADING HABIT.

There are many uses to which dwarf-spreading conifers can be put, such as for undergrowth, covering banks and rock-work, or in forming dense, far-spreading masses in the open or around the margins of woods and plantations. For such purposes the following are most to be recommended :—

Cryptomeria japonica nana
Juniperus canadensis
„ communis compressa
„ Sabina
„ „ tamariscifolia
Juniperus procumbens
„ squamata
Picea excelsa Clanbrasiliana
Pinus montana
Taxus baccata ericoides
„ „ Dovastoni

### PIGMY CONIFERS.

Several varieties of coniferous trees are of remarkably dwarf and prostrate habit, and therefore well suited for culti-

vating in beds or on rock-work. The smallest would include *Juniperus communis compressa*, a neat and miniature plant that rarely exceeds four inches in height; *J. communis nana*, which on the Scotch and Welsh hills spreads to a considerable distance, though hardly 6 inches high; and *J. Sabina tamariscifolia*, with bright bluish green foliage and of very dwarf and procumbent habit.

*Pinus Strobus nana*, *P. cembra pumila*, *P. Laricio pygmæa*, and *P. silvestris pygmæa* are all very compact dwarf forms of their several species, none of which rise to a greater height than about four feet.

Amongst the spruces there are several very interesting and neat pigmy forms, the best of which would include *Picea excelsa pygmæa*, *P. excelsa Clanbrasiliana*, *P. excelsa pumila*, *P. excelsa Gregoryana*, and *P. nigra Doumettii*. These are generally of dwarf spreading growth, from two feet to five feet in height, and decidedly interesting and useful for the purposes already referred to.

*Cryptomeria japonica nana* and the dwarf form of the variety *elegans* are also neat and useful conifers of small growth; and the same applies to *Thuya dolabrata lætevirens* and *T. dolabrata nana*, *T. orientalis pygmæa*, and *T. orientalis nana*.

Several varieties of *Cupressus* are of small and pleasing growth, such as *C. Lawsoniana nana* and *C. Lawsoniana nana glauca*, *C. obtusa nana* and *C. obtusa aurea nana*. *Taxus baccata nana* is a dwarf spreading variety of the common yew, that rarely rises more than three feet from the ground; and *T. baccata cricoides* is likewise of unusually low growth, and furnished with small heath-like foliage.

These include the smallest growing varieties, but there are others of slightly taller habit, which would, however, hardly come within the scope of such as are suitable for the rock garden or flower bed.

## CHAPTER VI.

### CONIFERS FOR ECONOMIC PLANTING.[1]

OUT of about two hundred species of conifers that have been described in this book it is a rather strange fact that not twenty can be recommended for economic planting, or, in other words, for the value of the timber they produce. Equally strange, too, is it that, with perhaps one exception, the very trees the timber of which is imported in such large quantities to this country for constructive purposes have received but little attention at the hands of the British planter, being found unsuitable in one way or another for extensive planting in almost every part of the country.

From long personal experience the following are the only species, so far as is known, that can be recommended where the value of the timber produced is a point of first consideration.

**The Common Larch** (*Larix europæa*) has no equal as a profitable timber conifer in this country, and I make this statement after years of note-taking and comparison of it with three other conifers whose merits place them high in the rank of such as are suitable for economic planting. Some of the valuable properties of this tree are as follows:—First, no other conifer is so valuable in a young state, as from the first the thinnings can be utilised for stakes, temporary fencing, and other purposes, and this can be said of no other conifer grown in our woods, at least the durability of the timber would not in any other tree be sufficient to repay the cost of erecting or otherwise converting.

[1] Condensed from my paper read at the Chiswick Conifer Conference; and contained in the "Journal of the Royal Horticultural Society," vol. xiv., 1892.

Then the larch is a hardier conifer than any other I know of, being in this respect quite equal to the Scotch and Austrian pines, while it will produce timber rapidly on very poor soils, and timber which, on comparison, is of greater durability, besides being cleaner and more easily manipulated than that of any other coniferous tree grown in this country. The trunk of the larch, comparatively speaking, is neither knotty nor crooked—points that are much favoured by timber-merchants—and this is not only referring to closely-grown plantation trees, but to isolated specimens, for above all trees the larch is the one that is least inclined to throw its vigour and substance into the formation of heavy side branches. Another point in favour of this valuable tree is that a greater number can be grown to the acre, or, in other words, the number of cubic feet of larchwood that can be produced from an acre is greater than that of any other conifer I know. The durability of the wood of the larch is well known, and as compared with that of either the Scotch or spruce is about doubly durable. A fence of larch cut from trees of from twenty to twenty-five years' growth will last from seventeen to twenty years, while that of the spruce lasts about nine years, and Scotch fir a shorter period. This refers directly to rails, not to posts, which decay in a much shorter time. For mining and railway purposes the durability of larchwood makes it much sought after, its value being still further enhanced by its extreme lightness, a cubic foot of seasoned wood weighing only 34 lbs. Substitutes for the larch have often been recommended, but in the true sense of the word none can be termed substitutes except, indeed, in the narrowest sense, although, doubtless, some of those whose claims have been set forth might reflect one or more of its valuable qualities, but this is the widest limit of comparison.

It is most unfortunate that of late years the larch has, in certain situations and under peculiar circumstances, suffered much from canker and blight; indeed to such an extent has this fell disease become disseminated throughout Great Britain that future large plantings of the tree are not likely to

be undertaken. The disease is at present almost unknown in Ireland, and I have never seen an instance when the larch is growing on reclaimed peat bog.

**The Corsican Pine** (*Pinus Laricio*) is another conifer of great value for profitable planting in this country, and one that I feel certain will yet outrival in this respect any other of the family to which it belongs. It is of very rapid growth, and is well suited for planting even in the most exposed and wind-swept situations; a non-fastidious subject as to soil, and withal, perhaps, the most valuable timber-producer, excepting the larch, that has ever been brought before the British arboriculturist. Having as yet been tested to no great extent for timber-producing purposes, it may, perhaps, be premature to speak too loudly in support of its qualities in that respect; but as I have cut up and utilised in various ways some of the biggest logs that have been grown in this country, I may be allowed to at least venture the remark that the timber is of excellent quality, and peculiarly well suited for constructive purposes. Speaking of trees of fully fifty years' growth, I have found the wood strong, tough, elastic, very resinous, and readily worked. I have experimentally used home-grown Laricio wood for many purposes, and always with very satisfactory results—some of the largest planks employed in this way being fully 27 inches wide, and cut from trees that girthed 9 feet at a yard from the ground. Planks that were used for several purposes both in and out of doors have stood a test of fully twelve years, in such a manner as to give one the impression that few of our home-grown coniferous woods can surpass that of the pine in question. In summing up, it may be said that the Corsican pine is perfectly hardy everywhere in these isles, a tree that will thrive well and produce large quantities of timber on poor gravelly soils, one that is readily and cheaply raised from seed—all qualities of the highest value, and such as are rarely so well concentrated in any other species. The rate of growth is rapid under favourable circumstances. After being planted for five years the average annual rate of growth for the next ten years is, in

specimens I have measured, as much as 30 inches in height. Stem bulk is, likewise, well carried on with this increase in height, and quite recently I examined a plantation of thirty-two years' growth in which *Pinus Laricio* had attained to 65 feet in height, and with many of the stems girthing from 5 feet to fully 6 feet at a yard from the ground. Standing alongside one of the largest trees, I counted around me no less than nine others whose average stem girth was 5 feet 4 inches, and the height 65 feet.

**The Douglas Fir** (*Pseudotsuga Douglasii*) is in certain situations a valuable timber-producing tree; but to grow it to perfection good soil and sheltered valleys are quite a necessity. Had we the cañons and deep hilly gorges of some of the North American States, there can be little doubt that the Douglas fir, from its suitability to our climate generally, would be one of the most valuable timber-producing trees that we could plant. In this country, under peculiarly favourable circumstances, I have known the Douglas fir to produce 240 feet of timber in fifty years, or nearly 5 feet per year for half a century. In taking the average size of the trees in a plantation formed twenty-two years, the dimensions were as follows:—Height, 76 feet; girth of stem at 24 feet, 4 feet; cubic contents fully 50 feet: thus giving an annual increase in wood of $2\frac{1}{4}$ feet. The average cubic contents of each tree in another wood, mainly composed of the Douglas fir, was nearly $2\frac{3}{4}$ feet per annum for thirty-five years. By way of experiment I had several large trees cut up, and utilised for several purposes—fences, door-posts, boat masts, etc., and with fairly satisfactory results. I do not wish to say one word against this my favourite fir, but the truth must be told, and my own experience, gained principally on a low-lying, maritime estate, which favoured the growth of most trees, is, that the Douglas fir must occupy a sheltered situation if either ornament or utility be considered as points of importance; indeed, a lengthened experience gained on an estate where it is, perhaps, grown in greater quantity than on any other, has now fully convinced me that the Douglas fir

is an ill-chosen subject for exposed ground. The timber is light, but strong, has a pleasant yellowish tinge, works readily, and polishes nicely.

**The Weymouth Pine** (*P. Strobus*) when viewed in an economic sense is well worthy of culture. Unfortunately, like the Douglas fir, it cannot succeed in exposed situations, and is rather particular as to the class of soil in which it is planted. At Gwydyr Castle, in Wales, at Longleat, and other places, the tree succeeds well, and at the former it has attained to 100 feet in height, the boles being perfectly straight, free of branches for half the height, and girthing $8\frac{1}{2}$ feet at 4 feet above ground level. In thinning a mixed plantation of the present tree and the Douglas fir, I noted that trees of the former, thirty years old, were 57 feet high, with stems girthing 4 feet 2 inches at a yard from the ground. On thinning a plantation of the Weymouth pine growing on rather dry and light gravelly soil, many were "pumped" or rotten at the core—a timely warning to planters of the tree. The timber is soft, light in proportion to its bulk, free from knots, and easily worked.

**The Scotch Pine** (*P. silvestris*) will, for economic planting, always hold a high rank, it being of great value for planting on poor gravelly soils and in cold, exposed sites No doubt this pine will always be extensively planted wherever shelter is wanted, and rightly so, for few others are so well suited for withstanding the cold, cutting blasts of our exposed hill-sides. The almost valueless quality of the timber produced in this country generally will always be a serious drawback to the extensive use of this particular species; but this is in great part counterbalanced by the hardy nature of the tree, the great amount of shelter it affords, and the rapidity of growth on poor thin soils. The best quality of Scotch pine timber, such as that produced in some of the northern Scottish counties, and Bedfordshire, in England, no doubt realises even at the present time a fair price; but, generally speaking, that produced throughout Scotland, England, as a whole, and also in Ireland, is of so

inferior quality as hardly to fetch the price of second-rate firewood.

**The Giant Arbor vitæ** (*Thuya gigantea*).—Whether for utility or ornament, we have in this species a valuable addition to our forest trees, and it is the opinion of those who are most competent to judge that it will be one of the trees of the future in this country. After a fair and impartial trial on my own part I have found it to be quite hardy, even at high altitudes, a fast grower and rapid timber producer, a non-fastidious subject as regards the quality of soil in which it is planted, and one of the easiest managed and most accommodating of trees.

From my note-book I find that the average annual rate of growth of twenty-six specimens growing under dissimilar conditions is 22 inches. The timber of thirty years' growth that I had cut up and converted was of good quality, but much better results may be expected from more fully matured wood. As only about half a century has elapsed since the introduction of the tree, we must be careful in sounding its praises; but so far our experiments with both the tree and its timber are highly encouraging. It may be well to mention that there are several forms of this tree, some quite valueless for economic planting.

**The Norway Spruce** (*Picea excelsa*).—The value of the common or Norway spruce in economic planting is already well-known, fully-matured timber having been largely cut up and converted for many estate purposes. Though not equal to either the larch or Corsican pine in lasting properties, the wood of the spruce is yet sufficiently durable to cause it to have been largely employed in fencing and the erection of sheds and out-buildings. One great point in favour of the tree is that it will grow where many others would fail, while it grows rapidly, and affords a great amount of shelter.

**The Austrian Pine** (*P. Laricio austriaca*), where shelter is a point of first importance, stands, perhaps, unrivalled by any other coniferous tree. Of fairly good quality, too, is the

timber, but it is generally rough, knotty, and hard to work, and that, too, even when the trees are growing in close order. The tree inclines more to spend its energy in the formation of many weighty side branches than in the building up of a clean and gradually tapering stem. The Austrian pine grows well on almost any class of soil, and bears exposure to rough winds, as I have ofttimes noticed on the bare and exposed Welsh hill-sides. Several large trunks that I had cut up for the express purpose of testing the quality of the timber turned out well, the plants being remarkably resinous, of a dirty yellow colour, and rather hard to work. It stands the changes from wet to dry as well as any home-grown timber I know, and the experiments I undertook eleven years ago on the Ogwen River in North Wales have turned out quite satisfactory.

**The Cluster Pine** (*P. Pinaster*).—So far as the value of the timber of this pine is concerned, the tree might almost be described as valueless for economic planting. That it will thrive well and produce fine, bushy specimens where very few other trees could succeed has been well exemplified along the Mediterranean coast, as well, indeed, as in not a few maritime districts of Great Britain. This of itself renders the tree one of great value, and eminently qualifies it for using as a nurse to other less hardy kinds. The rate of growth is rapid, several specimens growing on gravelly soil that I measured having produced 90 feet of timber in thirty-three years.

**Nordmann's Fir** (*Abies Nordmanniana*), when better known and more readily procured, will no doubt be used for afforesting purposes. It grows rapidly when suitably placed, a number of specimens of which I kept a record having produced nearly 2 cubic feet of wood annually, while the upward growth was 2 feet 3 inches in the same time. From the appearance of the wood of trees grown in this country, which have been cut up under my own supervision, the quality of that produced in its native country would seem to be well sustained, it being firm, clean, and readily worked. Unfortunately the tree is apt, especially when growing under adverse circumstances, to become infested with woolly aphis.

**Pinus monticola** produces a large bulk of excellent elastic timber, which is light, tough, and easily worked.

**Cupressus nootkatensis** (the Nootka Cypress) is likely to turn out a useful forest tree, it being very hardy, free of growth, and producing fine and clean-grained timber. The production of timber is somewhat slow even when the tree is growing on rich soil, while the appearance of the tree in our woodlands is anything but ornamental owing to the loss of the branches consequent on close order of growth. The stem is usually "carrot-shaped," or with a quick taper from the ground upwards.

**C. Lawsoniana** (the LawsonCypress).—For forest planting this cypress might be included, its great hardihood, ease of culture, and quality of timber produced, being special recommendations. Growing in soil of good quality, I have noted the upward rate of growth to be 43 feet in twenty-seven years, but this is rather unusual. Home-grown timber is clean, light, easily worked, and of a pleasing yellow colour. For indoor work it is well suited, and fencing posts made of the wood are lasting well.

**The Redwood** (*Sequoia sempervirens*) is rarely recommended for profitable planting, but from experiments I have undertaken and measurements made it would seem to be a more valuable tree than is generally supposed. It must, however, be grown in good, rich soil and where shelter is afforded, perferably, too, in maritime situations. The rate of growth under such conditions is rapid, and the timber of good quality. In one instance I have known the tree to reach a height of 84 feet in twenty-nine years.

**Mount Atlas or African Cedar** (*Cedrus atlantica*).—This tree has several good qualities for economic planting, it growing well on cold stiff soils, and standing exposure in an almost remarkable manner.

**The Large-fruited Cypress** (*Cupressus macrocarpa*) is one of the most valuable species for planting in exposed maritime situations, and its value in economic planting lies in its affording a great amount of shelter, and

growing where few other species could succeed. The timber I have cut up is of excellent quality.

**Tsuga Mertensiana** may yet turn out a valuable tree for afforesting purposes. It grows rapidly in this country, and produces a large amount of timber which seems little inferior to, and not unlike that of, the larch. It is fine grained, works readily, and of a yellowish white colour.

**The Lebanon Cedar** (*Cedrus Libani*) has several good qualifications to rank as a forest tree. It grows rapidly, stands exposure well, and produces a large quantity of fairly valuable timber. The lasting properties of the timber are dwelt upon in the following chapter.

## CHAPTER VII.

### QUALITY OF BRITISH-GROWN CONIFEROUS TIMBERS.

WITH the object of testing the quality of the timber of the various species of coniferous trees cultivated in this country, I have lost no opportunity during the last twenty-two years either of collecting specimens or conducting experiments. This, I need hardly add, has been attended with considerable difficulties, and it has not been easy to procure home-grown specimens of a suitable age and size to render the experiments thoroughly trustworthy. Fortunately for the carrying out of such experiments, I have had the management of parks and woodlands where numbers of the rarer conifers had to be removed in the ordinary course of thinning, while the wind has, on not a few occasions, acted as a kind friend in procuring specimens that would not otherwise have been obtainable.

As will be seen from the measurements given throughout the following notes, probably the largest and oldest specimens in this country of *Pinus Laricio*, *P. Laricio austriaca*, *P. ponderosa*, *P. Pinaster*, *P. Strobus*, *P. muricata*, *Cedrus Libani*, *Cupressus macrocarpa*, *C. Lawsoniana*, *C. torulosa*, *Cunninghamia sinensis*, *Araucaria imbricata*, *Abies grandis*, *A. Nordmanniana*, *Picea nigra*, *P. morinda*, *P. sitchensis*, *Sequoia gigantea*, *Cryptomeria japonica*, *Thuya gigantea*, and *Juniperus virginiana* have been cut down, and portions of the converted wood used in various ways by way of experiment in testing their quality.[1]

Whilst carrying out these experiments, few things have surprised me more than the way in which the timber of certain species of coniferous trees is affected by the particular

[1] Portions of this paper were communicated by me to the *Gardener's Chronicle*, where they appeared in a series of articles during 1895.

quality of soil on which it is produced; indeed, the difference between immature and nearly fully matured timber is trifling when compared with the quality as affected by soil. One or two instances may be cited as examples:—In thinning a plantation composed of *Pseudotsuga Douglasii*, *Pinus Strobus*, and *Picea morinda*, fifty-three out of seventy-one specimens of *P. Strobus* were pumped or rotten at the core, and utterly unfitted for use in any way. The trees were growing on sandy loam, had been planted twenty-six years, and contained, on an average, 25 feet of wood each. Now, having felled trees of the same kind on various other qualities of soil, and found the timber perfectly sound, deductions will not be difficult to make. A still more curious example of how coniferous timber is affected by the soil on which it was grown was illustrated a few years ago on an estate on the banks of Lough Neagh, in Ireland. A large number of fencing poles, larch and Scotch fir, were being cut from two neighbouring plantations of the same age and size, but growing on widely different soils—peaty and gravelly. The Scotch fir timber from the peaty soil was soft, spongy, and nearly white in colour, while that from the gravel was hard, firm, and of a bright yellow colour. So pronounced was the difference in the quality of the two timbers that the woodmen, in carrying the poles to the hard road adjoining the plantation, had not the slightest difficulty in stating from which wood the particular poles had been brought, that from the gravelly soil having a sharp ring like metal when thrown from the shoulder, whilst that grown on peat had a soft, dull thud. Larch timber grown on gravelly soil is usually pumped or rotten at the heart, and in a remarkable instance with which I had to deal, every larch had to be removed from a large mixed plantation of twenty-six years' growth, growing on soil of this description. Such facts as these are very significant, and show how careful we must be in condemning any coniferous tree when judged from the quality of the wood as produced on any particular class of soil and that, with certain species at least, the observations

must be extended over a fairly wide field of investigation. In the following notes I have been careful not only to give the age of the tree from which the timber has been cut, but also the quality of soil on which it was grown; and it may be well to add that in the case of experiments, none of less than seven years' standing will be recorded. Greater attention, too, has been bestowed on such species as produce timber of sufficient size and of the best quality for economic purposes The arrangement is alphabetical:—

**Abies cephalonica.**—Age 33 years; cubic contents 27 feet; soil gravelly loam. Timber of good quality, and where it has been used in out-door work for eleven years, seems at present in an equally good state with Scotch pine of the same age. The wood is yellowish-white, firm, medium in weight, and, owing to the quantity of resin it contains, works smoothly, and takes a good polish. Used for forming side of temporary shed.

**A. grandis.**—Age 49 years; cubic contents 73 feet; soil gravelly loam, with a foot-thick coating of decayed vegetable matter. Timber of excellent quality, very weighty, resinous, and the concentric rings closely packed. Used for boarding both in and out of doors during the past eleven years, and given general satisfaction. The balsamic fragrance from the beautiful yellowish-white wood was, at the time of felling, distinctly perceptible for many yards away, and was commented upon by the woodmen engaged in felling and removing the specimen. I think the timber is quite equal to that of silver fir of similar age, but more resinous, and weightier.

**A. lasiocarpa.**—Age 18 years; cubic contents 16 feet; soil peaty. Timber much like that of the foregoing, and equally dark in colour, but proportionately lighter. Lasting quality not remarkable when compared with Scotch fir of equal age.

**A. nobilis.**—Age 42 years; cubic contents 47 feet; soil rich alluvial deposit. Timber of good quality, and for indoor work, at least, is to be highly recommended. It is light, but

hard and compact, and of a creamy-brown colour, though the latter varies greatly according to soil, that produced on gravel at higher altitudes being reddish-yellow, and much harder, though equally light in proportion to the bulk. I am much pleased with the quality of the timber of this tree, and consider that it is quite equal to that of the silver fir, but the quality and colouring is evidently greatly affected by soil and site.

**A. Nordmanniana.**—Oldest tree 53 years, but others of 23 years and 18 years have been tested; soil in first instance clayey loam, in second peaty; cubic contents 47 feet and 22 feet respectively. Timber reddish-yellow, fine and close-grained, and of excellent quality. Used for many purposes both in and out of doors, where it has been proved superior to that of the silver fir of even age. Specimens of the timber from boggy land in Ireland are remarkably hard and fine-grained, clearly proving that the tree is of great merit for afforesting peat bogs. From the experiments of nearly fifteen years' standing, I am confidently expecting that the Nordmann fir will prove a valuable timber-producing tree in this country.

**A. pinsapo.**—Age 53 years; cubic contents 47 feet; soil sandy loam resting on gravel. Timber of no great value, being brittle, and soon apt to decay, and hard to convert on account of the usually branchy stem. It resembles that of the silver fir in appearance.

**A. Webbiana.**—Age 23 years; cubic contents 21 feet; soil rich alluvial deposit, in sheltered low-lying situation. Timber white or nearly so, soft in comparison with that of other members of its family, but unusually easy to work and polish. It stood the changes of weather on an exposed shed for nine years creditably.

**Araucaria imbricata.**—Age 47 years and 52 years; cubic contents 38 feet and 51 feet; soil in both instances loam or gravel. The timber of these trees was of a beautiful yellow colour, closely-grained, firm, and worked and polished readily. My experiments prove that the timber is

not well suited for outdoor work, but when manufactured into household furniture it lasts well, ten years not seeming to have changed the wood in the least. The timber of young trees is notorious for its speedy decay.

**Cedrus Libani.**—Age of trees 99 years and 130 years; soil in both cases inclined to be gravelly; cubic contents 153 feet and 231 feet respectively. Timber reddish-white, brittle, though long-grained, light, easily worked, and susceptible of a good polish. I cannot agree with those who state that the timber is by no means durable, for my own experiments demonstrate that it is in this respect of considerable value. It is certainly apt to snap short, and is extremely brittle, but for all that it is of good lasting quality as shown by the following:—A trough for washing sheep was formed of this wood eighteen years ago, and after being subjected to drought and damp alternately, for it was sunk in the soil, the boarding when removed was perfectly sound, though dark in appearance. The tree from which the boards were cut was close upon a hundred years old, having been planted by the great statesman, William Pitt, when he owned the Holwood property, in Kent. The boards were fully 2 inches thick, and of various widths up to 2 feet, and the trough 12 feet long, by 4 feet wide. The position in which the timber was placed was one of the most trying, for, being sunk in the soil, and only filled with water during the sheep-shearing season, the vicissitudes of drought and damp were very considerable, and well fitted to test the quality of wood. The timber lasts well when converted into furniture. In some of the unusually large specimens which have been converted at Woburn Abbey, I consider the timber very near to that of the larch, both in appearance and quality, but it is not so elastic.

**Cryptomeria japonica.**—Age 43 years; cubic contents 47 feet; soil black, dampish loam, in a low-lying and well-sheltered situation. Timber remarkably light, nearly white, soft, and easily worked. In the dry it has remained sound for twelve years. Compared with foreign planks, those produced in this country differ but little.

**Cunninghamia sinensis.**—Age uncertain, probably 34 years; cubic contents 27 feet; soil rich black loam. Timber of a beautiful light mahogany colour, firm, clean-grained, and taking a good polish. That of a specimen cut at Esher Place,[1] Surrey, planted fully thirty years, and 37 feet high, was of good quality, and the colouring rich, though not equal to the first-mentioned tree. It was growing on deep sandy soil, but was shabby of appearance, and this was the reason for its removal.

**Cupressus Lawsoniana.**—Age 27 years; cubic contents 19 feet; soil gravelly loam. Timber of a pleasing yellow colour, very close-grained and hard, and works well under the tools of the carpenter. Fences of posts made from the wood have stood a seven years' test satisfactorily; but for household carpentry the wood is evidently best suited. It is sweetly scented and very elastic.

**C. macrocarpa.**—Age 38 years; cubic contents 43 feet; soil good yellow loam. Timber of first-rate quality, being remarkably hard and very close-grained. It is barberry-yellow in colour, but towards the centre reddish-yellow, very compact and close-grained, and it works smoothly under the tools of the carpenter. The lasting qualities, both in and out of doors, are quite satisfactory. I consider the timber of this cypress superior to that of most of our home-grown woods.

**C. Nootkatensis.**—Age 23 years; cubic contents 19 feet; soil gravelly loam. Timber excellent, even in the immature specimen to which I refer, of a pleasant light yellow colour, and agreeably scented. It is light, close-grained, and, being clean, works and polishes regularly, but is rather brittle. When tested out of doors, the results were favourable, more so than was expected from the immature specimens at our disposal.

**C. torulosa.**—Age 35 years; cubic contents 26 feet; soil black loam. Timber highly fragrant, purplish-yellow, hard, close-grained, and fibrous. For indoor work it is

[1] A portion of the trunk which I sent to the Surveyor's Institution, London, shows well the beautiful colour and graining of the timber.

especially valuable, and when made into furniture has remained unchanged for fully thirteen years.

**Ginkgo biloba.**—Age unknown, being a wall tree; probably 50 years; soil light, rich loam. Timber soft, brittle, and of a light yellow colour. For indoor work it looks well, and appears little different after seven years' wear.

**Juniperus Bermudiana.**—Age uncertain; felled owing to injury by the frost. Height 17 feet; timber soft, light, easily worked, slightly fragrant, and of a buff yellow colour.

**J. communis.**—Wood of a beautiful yellowish-brown colour, hard, but readily cut, and very aromatic. Made into ornaments, it seems to stand well, there being no perceptible difference in thirty-eight years.

**J. recurva.**—The wood of a specimen 17 feet in height and 10 inches in diameter was hard, fine of grain, and took a nice polish.

**J. virginiana.**—Probably the largest and finest specimen of this somewhat rare tree that has ever been felled in Britain was cut down recently to make room for building operations in the pretty village of Esher, in Surrey. The tree was of unusual proportions, with a beautifully clean and well-rounded stem, which was destitute of branches for 33 feet in length, and contained fully 51 feet of timber. This is the wood used so largely in England in the manufacture of "cedar pencils," and that of the tree in question is of excellent quality and beautifully grained, the heartwood being of a fine red colour with a band of deep yellow around the margin. The fragrance of the wood is justly remarkable, and in the case of the Esher specimen could be distinctly detected at a distance of about twenty yards. The soil which produced this perhaps unique tree is deep sandy loam, and the position might be said to be partially sheltered at least.

**Larix pendula.**—Age, about 32 years; cubic contents 18 feet; soil light, deep loam. Timber dark brown towards the centre, lighter, almost white, outside; heavy, hard, strong, not so fine of graining as the common species. Have only cut up the wood, but not used it in any experimental way.

**Picea alba.**—Age uncertain, not less than 50 years; cubic contents 38 feet; soil black, damp loam. Timber light, soft, but compact, fine of grain, and of a pleasing bright yellow colour. It is so soft as to readily take an impression made by the finger-nail.

**P. morinda.**—Age 43 years; cubic contents 37 feet; soil loam or gravel. I have cut up many specimens of this particular species, but in all cases have found it exactly the opposite of what it is described by travellers.

Here it is weightier, firmer, and probably more brittle than the common spruce; but in trees of equal age I am inclined to say that it is the superior of the two. It is readily affected by soil.

**P. nigra.**—Ages varying from 30 years to 50 years. Removed all the trees from a plantation, so had ample opportunities of testing the quality of home-grown timber. Timber nearly white, sometimes yellowish-white, soft, and long of grain, very light, and readily indented. Lasts well when kept dry and in an equable temperature; but it is of little or no value, comparatively speaking, for out-of-door work.

**P. orientalis.**—Age 37 years; cubic contents 29 feet; soil gravelly loam. Timber not unlike that of the common spruce, but perhaps yellower in colour, and equally firm. Not tested for outdoor work; very satisfactory when used for pannelling.

**Pinus cembra.**—Age 43 years; cubic contents 29 feet; soil good stiffish loam. Timber soft and springy, easily worked, and susceptible of a smooth and fine polish. It is very light, and the graining so fine as to be hardly discernible. Thirteen years do not appear to have altered either the appearance or quality of the wood in the least.

**P. excelsa.**—Various ages from 30 years to 43 years; cubic content of largest 42 feet; soil good rich yellow loam. Timber highly fragrant and resinous, compact, but easily indented, and nearly white in colour. Out of doors it soon decays, but when kept as a plank sample the period of fifteen years since it was cut does not seem to have affected it to

any appreciable extent. For purely economic planting I do not consider that the tree will ever be valuable in this country.

**P. insignis.**—Age 38 years; cubic contents 33 feet; soil loamy. Timber clean, close-grained, easily worked, and of fair lasting quality. Not tried out of doors, but indoors it stands well.

**P. Laricio.**—Nearly all ages up to 71 years; cubic contents of largest 57 feet; soil gravelly. Timber of excellent quality, and well suited either for out or indoor work. It is yellowish-white in colour, very resinous, tough and elastic, easy to work, and planes smoothly.

Eleven years ago I instituted a number of experiments with the wood of the tree cut from a specimen, 18 feet of the butt of which contained 30 feet of timber, some of the planks being 27 inches wide. For fencing-posts, rails, shed-cleading, and such like, the timber was used, and with very promising results. In 1894 I examined the timber, and was surprised to find it so sound and well preserved, and in the case of that used indoors it has certainly hardened with age. Unlike the wood of several other species of fir, which get hollowed between the growths, owing to the loss of resin and shrinkage, that of the Corsican pine remains perfectly smooth, the beautiful longitudinal dark yellow resin-containing portions being quite intact after eleven years' wear. The timber does not splinter readily, but wears uniform and well when subjected to the almost constant bumping and rough usage consequent on railway travelling, as a large box which has been through many parts of England and Scotland since the Edinburgh Forestry Exhibition bears ample testimony. I consider the timber next to that of the larch for lasting qualities, at least amongst such conifers as have been found of sufficiently rapid growth to warrant their recommendation for forest planting in this country.

**P. Laricio austriaca.**—Ages ranging from 30 years to 43 years; cubic contents of largest 37 feet; soil gravelly. Timber very resinous, rough, owing to the branching stem,

remarkably strong and tough, and coarse of grain. Fully ten years have now elapsed since the timber was cut up and used for fencing, for supporting the bank of a rapid-flowing river, and for indoor carpentry. In every case the results have been satisfactory, and prove that when compared with the spruce and Scotch firs the wood is better than those. The timber becomes lighter with age, but owing to its generally rough, knotty nature, will never rank very high for constructive work.

**P. monticola.**—Age 36 years; cubic contents 41 feet; soil deep and sandy. Timber light, tough, elastic, and durable, easily worked, and polishes beautifully. This is a valuable tree for afforesting purposes.

**P. Pinaster.**—Age of several trees cut up 93 years; cubic contents 75 feet; soil gravelly, with a little loam. A goodly specimen that was straight as an arrow, and containing 99 feet of wood, was partially uprooted during a storm three years ago, and advantage was taken of the opportunity to have the timber converted in various ways, so that its value for estate purposes generally could be determined. Owing to the great quantity of resin present in the timber, the tree was weightier for its bulk than any other species that had come under my notice, with the exception, perhaps, of Abies grandis. A great part of it was sawn into boards of 2 inches in thickness, and as many of these boards were fully 3 feet wide, their value for constructive purposes, had the timber been of good value and worthy of conversion, would have been great. The wood works beautifully and clean, taking a smooth glossy surface under the tools of the carpenter, and several of these 3-feet-wide boards were cut into 6 feet lengths, and planed smoothly for preserving as samples of the wood. To various uses the remaining boards were applied, but one instance of their lasting quality will be sufficient. A number, fully thirty, were placed as boarding for the floor of a dry faggot-shed or barn—a well-built structure, and thoroughly ventilated. On examining these boards a few weeks back, it was found that they were one and all

perfectly rotten and falling to pieces, and that after they had not been in position more than about eighteen months. Every board had to be removed, having become permeated with dry-rot to such an extent that when let fall on the ground they fell to pieces. This was all the more strange as the boards had been allowed plenty of air, they being not nailed down or carefully placed side by side, but simply laid down with the double object of seasoning, and to form a temporary wooden floor beneath the dry faggots. When we take into consideration the size and age of the tree from which the planks were cut, as well as the great quantity of resin present, and which rendered the log so weighty in transit, the case seems all the more remarkable. But it has long been known that the timber of this pine is of no great value, and even for firewood purposes it comes in about third-rate.

**P. ponderosa.**—Age 54 years; cubic contents 44 feet; soil good loam. Timber heavy and saturated with resin, of a reddish colour, and not particularly durable. The strong resinous smell of the wood is justly remarkable, and the veining is much admired.

**P. rigida.**—Age probably 40 years; cubic contents 27 feet; soil sandy. Timber light, coarse-grained, brittle, and of no special value as produced in this country.

**P. Strobus.**—Age unknown; cubic contents 93 feet; soil vegetable mould, or shaly rock. Timber of good quality, clean, and easily worked, but much affected both by soil and site. British-grown timber revealed but small difference when compared with that sent to the late Colonial and Indian Exhibition.[1] I consider this a valuable forest tree for not too exposed parts of these isles, but it does not succeed well on too light or poor soils.

**P. tuberculata.**—Age unknown; cubic contents 44 feet; soil rich loam. Timber very resinous, reddish-white, brittle, and finely grained. Not tried out of doors, but it burns fiercely.

[1] Excellent opportunities were afforded me by Professor Macoun, of Ottawa, Canada, for comparing many specimens of our home-grown coniferous woods with those sent to the Colonial and Indian Exhibition.

**Pseudotsuga Douglasii.**—Age from 25 years to 45 years; cubic contents of latter 57 feet; soil gravelly. Timber, when young, soft, and liable to insect attacks and sudden decay; when older, of a desirable yellow colour, hard and firm, and susceptible of a high polish. It gets darker with age, hard and brittle, and difficult to work. For fencing-posts, boarding, and boat masts outdoors, and in temporary work where not exposed to the weather, I have used the timber extensively, and in every case the result has been quite satisfactory. I do not, however, consider the timber equal in lasting properties to that of three other conifers, whose merits, as regards quantity of timber produced and fitness for culture in this country, place them higher in the rank of such as are suited for economic planting. The production of timber by the Douglas fir is ahead of that of any other coniferous tree in this country of which I have kept a record, *viz.*, 240 feet in fifty years, or nearly 5 feet per year for half a century.

**Sequoia gigantea.**—Age 33 years; cubic contents 73 feet; soil loam or gravel, sheltered. Timber very beautiful, the ground-work being yellow, marked with deep red bands longitudinally. It is light in proportion to the bulk, compact, and works readily. I had the butt of the above specimen cut into 2-inch thick boarding, for the purpose of hut-making for charcoal burners, and was, with everyone else who saw them, astonished at the deep, rich colouring and shading of the wood. The lasting qualities are not very remarkable, although the timber darkens with age, and the outdoor experiments were not very encouraging. For indoor work of various descriptions the wood is well adapted.

**S. sempervirens.**—Age unknown; cubic contents 52 feet; soil alluvial deposit; sheltered valley. Timber of excellent quality, of a pleasing brick-red colour, very finely and closely grained, and susceptible of a high polish. It cleaves into long lengths, and is unusually free from knots and general timber defects. Not used to any extent out of doors,

but as furniture and room-panelling the home-grown wood seems to be peculiarly suitable.

**Taxodium distichum.**—Age unknown; cubic contents 34 feet; soil black, damp loam. Timber brown, light, but very fine-grained, and works smoothly.

I am much taken with the timber of the deciduous cypress, but, unfortunately, my experiments are hardly worth detailing. Indoors it has stood well; outdoors fairly well for the period of time.

**Taxus baccata.**—Age up to 150 years. Timber exceedingly hard, weighty, and close-grained. It is of a pleasing deep reddish-brown colour, tough, elastic, and susceptible of a high polish. Not much in demand, unless when offered in large quantities.

**Thuya gigantea.**—Age 31 years; cubic contents 31 feet; soil rich and suitable. Timber of a pleasing yellow colour, fine-grained, light in proportion to the bulk, and very readily cut up and worked. My experiments with the wood for fencing purposes are not very encouraging, but then it must be remembered that it was far from mature—in fact, could only be considered as in a juvenile state. Where used for indoor work, the results are favourable. I consider the tree one of the greatest value for the quick production of fairly good timber.

**Tsuga canadensis,**—Age 53 years; cubic contents 37 feet; soil rich, damp loam; sheltered. Timber hard, heavy, rough-grained, and inclined to splinter. It works well, and takes on a good polish. The slower-grown timber seems to be hardest and finest of grain; that of old, rapidly-grown trees being crooked and rough.

**T. Mertensiana.**—Age 28 years; cubic contents 31 feet; soil good rich loam; sheltered position. Timber yellowish-white, smooth, fine of grain, and susceptible of a nice polish. I have used the wood for several out-of-door purposes, and with the best and most satisfactory results. As fencing-posts, it equals the larch of similar age, while for furniture it would seem to be well suited. I consider this a very valuable timber-producing tree for planting in this country.

## CHAPTER VIII.

### COMMERCIAL ASPECT OF CONIFERS.

WHEN viewed in a truly commercial sense, the various species of coniferæ are perhaps the most useful and valuable of all trees to mankind. For general utility the timber is not surpassed by that of any other trees, and possesses qualities that render it peculiarly suitable for building and general constructive purposes, while being obtainable in such vast quantities the price is comparatively cheap. The arts and manufactures are also largely indebted to coniferous trees for many of their staples—tar, pitch, turpentine, resin, balsams, spirits, paper pulp, etc. Tar, which at present is largely imported from the Baltic ports and Southern United States of America, is obtained principally from *Pinus palustris*, *P. Pinaster*, and *P. silvestris*. Turpentine comes from incisions made in the stems of several species of *Pinus*, principally *P. Tæda*, *P. silvestris*, and *P. palustris*. The famous Strasburg turpentine is obtained from the common silver fir (*Abies pectinata*), while the larch is the source of the Venice turpentine of commerce. Larch bark contains a large quantity of tannin matter, and this may also be said of that of the Canadian hemlock fir (*Tsuga canadensis*), which is, however, inferior in quality to that of the larch. From spruce branches that well-known beverage, spruce beer, is principally obtained, while in the manufacture of gin the much esteemed flavour and aroma are mainly due to our common juniper. In New England the sapling pines are made into pasteboard, and the fibre threads of the wood into cloth. That valuable product coniferin is obtained from several species of *Abies* and *Pinus;* an oil largely employed in veterinary practice

from *Juniperus oxycedrus;* while the common Savin (*Juniperus Sabina*) is much appreciated in medicine.

Remarkable properties are possessed by the secretions of the Lebanon cedar.

Articles of clothing, as also mats, sails, and ropes, are made from the inner bark of the giant arborvitæ (*Thuya gigantea*), while in some parts of Italy the leaves of *Pinus halepensis* are used instead of straw for bedding horses and cattle.

It may not be generally known that the seeds or nuts of certain coniferous trees, particularly the genus *Pinus*, not only enter into the making of confectionery in this country, but are the staple food of, and form an article of commerce amongst, several of the American and Asiatic hill tribes. Even on the Continent the large and deliciously-flavoured seeds of the Swiss stone pine (*Pinus Cembra*) are eaten by the peasantry, while they are also largely employed as an article of diet throughout Russia and Siberia. In Italy those of the stone pine (*P. Pinea*), two of which are contained beneath each scale of the large, shining brown cones, are much valued by the peasantry, they being considered a great delicacy, especially when roasted. The Italian cooks also use them largely in their soups and ragoûts, and in the Maritozii buns of Rome. In the vast pine woods which lie along the Portuguese seaboard, the filbert-like cone kernels of the same species are also largely used as food. In passing, it may be of interest to state that both the above species thrive well in this country, and have produced seeds that are quite equal in point of flavour and size to those sent from abroad. The sweet and highly nutritious seeds of the nut or digger pine (*P. Sabiniana*) are particular favourites of, and much relished by, the North American Indians, forming, as they do, their chief food resource for nearly half the year. Climbing the trees, the men and boys beat off the cones with heavy sticks, or, failing to reach them in that way, cut off wholesale the branches on which they are most plentifully produced. Owing to the hard, bone-like character of the cones, the seeds can only be readily extracted by means of fire, and an in-

teresting sight it is to see the squaws seated by the bright camp fire roasting the cones, until the hard scales fly open with a crackling noise and liberate the seeds. The cones are truly noble objects, one now before me produced in Southern England being fully 6 inches long by nearly the same in greatest width, and of a pleasing rich chocolate colour, and composed of sharply hooked and downward bent scales. The seeds are large, only thirty being included in one ounce weight.

Amongst the Afghan villagers of the Himalayas, the seeds of *P. Gerardiana* are highly prized, while they are regarded as a rare delicacy by the poorer residents in Northern India ; and in Nepaul and Bhotan those of the beautiful *P. longifolia* are much in request. The peculiarly interesting *P. monophylla* produces small cones hardly more than 3 inches long, but the seeds, which are wingless, and produced two beneath each scale, are a rare delicacy amongst the hill tribes of the Sierra-Nevada mountains, and also form an important article of commerce amongst several of these Indian communities. *P. edulis* also produces large and very palatable seeds, though the cones are but small, and in New Mexico and Colorado they are extensively used as food by the native Indians of these parts. The well-known *Araucaria imbricata* produces, even in this country, immense globular cones about 9 inches in diameter, each containing upwards of two hundred seeds. These are large and edible, and used as food—raw, roasted, and boiled—by the natives of Chili, particularly the Araucaro Indians of the South. To the English palate they are not very agreeable, whether raw or cooked, the flavour being decidedly resinous, this, however, to a great extent being got rid of by boiling the seeds.

It is hardly likely that pine nuts will ever find much favour in this country, although the comfits supplied by Messrs. Fuller, of the Strand and Regent Street, and which consist of the kernels embedded in sugar, are both toothsome and enjoyable.

## CHAPTER IX.

### ENEMIES OF CONIFERS.

### (1) *Insects.*

SEVERAL species of coniferæ are at times attacked by insect pests, the following being a list of such as have been found most injurious, with an account of the trees they infest, and the best known means for their extermination.

**Pine beetle** (*Myelophilus piniperda*).—This beetle attacks the Scotch pine (*Pinus silvestris*), the Corsican (*P. Laricio*), the Austrian (*P. Laricio austriaca*), and the Aleppo (*P. halepensis*). I have also known it to attack the spruce (*Picea excelsa*) and the Weymouth pine (*P. Strobus*), but very rarely. At Kew, both *Pinus muricata* and *P. insignis* have been attacked by this beetle. The principal injury done by this insect consists in the destruction of the leading shoots of the tree it attacks. It bores into the side of the shoot till it reaches the pith, then tunnels upwards, making an exit at the terminal bud. This tunnelling so weakens the shoot that it is easily broken over during stormy weather

During the summer months—June, July, and August—the beetle is most abundant. The beetle is propagated in dead and dying wood; old stumps are also favourite breeding-places.

Unfortunately it is not only unhealthy trees that are attacked by this insect, for I have had to deal on several occasions with the attacks on rapid-growing specimens of several species of *Pinus*. The insect is greatly on the increase in this country, and during the present season the plantations in Forfarshire, Bedfordshire, and other parts of the country have suffered to an almost alarming extent from its attacks.

Burning all dead and dying brushwood, so as to do away with the breeding-grounds of the insect, is the only reasonable remedy when whole plantations are attacked ; but in the case of single specimens, collecting and burning the affected shoots is to be recommended.

**Pine weevil** (*Curculio Abietis*) attacks several species of *Pinus*, *Picea*, and *Abies*. The buds of the leading shoots or the bark on the stem and branches suffer most. It is a blackish-brown beetle, nearly ½ an inch long, and usually attacks young trees up to twelve years old. The breeding-ground being dead and dying wood, recently felled trees and their stumps, one means of retaining the insect in check will be the keeping of the woodlands free from such. Fresh pieces of pine bark placed beneath infested trees often prove excellent traps. The trees should be shaken carefully, and the traps examined the following morning, when many insects may be destroyed.

**Pine sawfly** (*Lophyrus Pini*).—Although not plentiful in this country, this insect occasionally commits much damage by defoliating the conifers on which it is found. The full-grown caterpillar is of a greenish-yellow colour, about 1 inch long, the male smaller than the female. By shaking the caterpillars into a sheet placed beneath the infested tree, many may be collected and destroyed. Sprinkling the trees with Paris green or Hellebore is also to be recommended. I have counted one hundred and seventy caterpillars on a shoot under twelve inches long.

**Pine shoot moths** (*Retinia turionella* and *R. buoliana*). —These usually attack the various species of *Pinus*, but I have only found them on *P. Strobus*, *P. excelsa*, *P. silvestris*, and *P. Pinaster*. Quite recently I visited a Scotch pine plantation, the buds of the trees in which were in many instances quite destroyed by the caterpillars of this beautifully coloured moth. At the base of the buds the moth lays its eggs, and into these the caterpillars enter by hollowing out the centre, thus destroying their vitality, and causing them to feel soft and empty to the touch, and to take on a withered

appearance. Hand picking specimen conifers is to be recommended, but with an infested area of trees it is very difficult to deal. Lighting a fire to windward of the infested trees, and causing the smoke of coal or creosote to pass over, is an excellent remedy.

**Larch miner** (*Coleophora laricella*) lays its eggs at the end of June on the needles of the larch, the tiny caterpillars mining into and feeding on the interior of these, causing them to turn brown and withered. Living in the tube thus formed during the winter, it changes to a pupa, and ultimately to a moth.

**Bostrichus typographus** appears like fine white wool spreading over the stems and branches of several species of conifers. It attacks the Douglas fir, *Abies Nordmanniana*, *A. pectinata*, *Pinus Strobus*, and several other species. Trees growing under unfavourable conditions suffer most, and the best remedy with infested specimens is to correct these conditions.

**Larch aphis** (*Chermes laricis*) attacks the larch, but its depredations are not considerable.

**Sprucegall aphis** (*Chermes Abietis*).—The attacks are confined principally to the common spruce (*Picea excelsa*), but I have also known *P. orientalis*, *P. sitchensis*, and *P. nigra* to be severely damaged by the same insect. The attacked trees are rendered very unsightly by reason of the cone-like excrescences that are formed at the instigation of the insect on the shoots. It is brought about by the female aphis piercing with her beak or sucker one of the buds, and drawing off the sap, the consequence being an unnatural growth at that part. The only known remedy is to collect the cone-like excrescences and have them destoyed.

**Pissodes notata** attacks young trees of several species of Pinus, but principally such as are growing under unfavourable conditions. The eggs are laid on pine trunks, and the larvæ feed under the bark.

**Wood wasps** (*Sirex gigas* and *S. juvencus*) are by no means uncommon in the British Isles, and have been found on the larch, spruce, silver fir, and cedars. They are formid-

able and splendid insects—*S. gigas* being black and yellow of colour and like our common wasp, while *S. juvencus* is of a shining steel-blue, with reddish markings on the male. The larvæ are stout white grubs, which bore obliquely towards the heart of the tree, and often the galleries are in such numbers that the tree is killed thereby, and the timber rendered useless in consequence. I have found *S. juvencus* very plentiful on the Scotch and cluster pines, in Kent. Where wood wasps abound, dead and dying trees should be removed before the imagos appear in summer.

*Abies nobilis*, *A. amabilis*, and *A. lasiocarpa*, particularly the former, are subject to the attacks of an insect nearly allied to that which causes the American blight on apple trees. The attacked portions, generally the buds or base of the leaves, present gouty, usually cup-shaped swellings, and which, with the growth of the shoots, increase proportionally in size. When cut into, the swollen portions are of a spongy appearance, and these unsightly deformities not only tell hardly on the health of the trees effected, but render them utterly valueless from either an ornamental or commercial standpoint. An application of fir-tree oil has been found useful at the initial stage of the disease.

**Wireworms** injure seedling conifers of most kinds by gnawing the tender stems through at or above ground level. Amongst the rarer conifers *Abies nobilis*, *A. Nordmanniana*, *A. grandis*, *Pinus Cembra*, *P. Strobus*, and *P. Pinaster*, are often attacked. Paring and burning the nursery soil, or top-dressing with gas-lime, are fairly successful methods of keeping the wireworm in check; but after the seedlings appear above ground, pieces of buried carrot, potato, or oil-cake, act as excellent traps.

The above insects are only such as are commonly met with and commit most damage in this country, but there are many others.

### (2) *Animals.*

**Hare and Rabbit.** — These must come first on the list, being the most generally destructive to coniferous trees of any of our woodland animals. Immense damage has resulted from the depredations of both, particularly on estates where they are preserved and occur in quantity. Few coniferous trees would seem to come amiss to either the hare or rabbit, particularly during long-continued frosty weather ; and amongst others we have found the various species of *Cedrus*, *Cupressus*, *Picea*, *Abies*, and *Larix* at times badly damaged. The species of *Pinus* are, from their rough bark, more exempt from attacks, but under exceptional circumstances we have known many to suffer from the gnawing of both these animals, and some of the rarer and more tender have been proved to be particularly susceptible. *P. Bungeana*, *P. Hartwegii*, *P. longifolia*, and *P. monticola*, are freely attacked in a young state.

The best preventive, undoubtedly, is wire-netting placed around the specimens, and inserted in the ground in an outward curved position for about 6 inches. With standard specimens, where the stems are unbranched, the bark of the oak or Spanish chestnut, placed around the trunk and kept in position by bands of wire, has been found of decided value in warding off attacks. This system of protection is cheap, and well worthy of wide adoption.

**Squirrels** are far more destructive to coniferous trees than is generally supposed, they attacking not only the bark but the buds, young shoots, and cones. For the soft, woolly bark of *Sequoia sempervirens*, they have a far-famed liking, while the young shoots of many species of *Pinus* and *Picea* suffer to an inordinate extent during certain seasons. Even large branches and stems of *Pinus silvestris*, *Abies pectinata*, and *Larix europæa* have been so severely gnawed by squirrels that they readily broke across during stormy weather. The

cones of many species are attacked in a wholesale manner for the sake of the young succulent seeds, of which the squirrel is particularly fond. *Pinus Pinaster*, *P. Pinea*, *P. silvestris*, *P. Cembra*, *P. excelsa*, *P. Strobus*, and *P. monticola* are most frequently attacked. In 1879 enormous damage was done to larch plantations in the Forest of Dean by squirrels. In many places the surface of the ground was quite covered with the fallen and decaying *débris*, large branches, and in many instances the whole top of the tree, being broken off. The squirrels peeled off broad rings of the bark round the branch or bole of the tree. The parts of the stem and branches beyond the barked portions were thus killed, and rapidly decaying, soon gave way and were broken off by the wind. During the present season the woods on the estate of Carolside, near Earlston, belonging to Lord Reay, have suffered serious injury from the attacks of the large number of squirrels by which they are infested. It is estimated that damage in this way to the extent of several hundred pounds has been done to the timber on the Carolside estate. The only way of lessening the evil is by reducing the numbers by shooting, and this should only be attempted when the squirrel is on the ground or a distant branch, so that injury to the stem and branches by the leaden shots may be minimised as much as possible.

**Rats, Mice, and Voles.**—When growing by the pond or stream many species of conifers are damaged by the above-named vermin. We have known the common rat to commit serious damage to the stems of *Picea nigra*, *Abies nobilis*, *A. balsamea*, *Cedrus atlantica*, *Fitzroya patagonica*, *Athrotaxis selaginoides*, *Torreya Californica*, and the common larch, by gnawing off the bark quite around the stem from the ground level upwards. By tying small branches placed on end thickly around the stems and smearing these with tar, a stop was put to further depredations.

The roots of young larch and Scotch pines have in certain cases suffered severely by the vole or water-rat, the bark of the stems just under ground level being also attacked.

### (3) *Birds.*

UNLESS in a few instances, the injury committed by birds to coniferous trees is not very great.

**Black game** are, perhaps, the worst enemies, but, fortunately, it is only in Scotland that their ravages are at all serious. The Scotch, Austrian, Corsican, and Weymouth pines would seem to suffer most, and on a large estate in northern Scotland thousands of trees have in a single season been denuded of almost every bud by these destructive birds. Smearing the young trees with Davidson's composition, or keeping boys to drive the birds off, are the only known means of lessening the evil.

**The Crossbill** when unable to procure its more natural food—coniferous tree seeds—will attack the buds of certain species of *Pinus* and *Picca*. These birds appeared in vast numbers and attacked the buds and cones of the Scotch pine to such an injurious extent in plantations in northern Ireland some years ago, that men had to be employed to shoot them down wholesale.

**The Bullfinch,** too, has been known to commit great damage in larch plantations by attacking the buds, particularly in early spring when other food is scarce.

**The Capercaillie** does great damage to young pine and larch woods in Scotland by destroying the terminal and other buds and shoots. The attacks are mainly confined to *P. silvestris* and rarely to the spruce (*Picea excelsa*) and larch, while the berries of *Juniperus communis* are eaten in quantity.

### (4) *Diseases.*

THESE are many, but only such as are of special interest to the cultivator of coniferous trees in this country, whether from

their wide range or injurious effects, will be brought under notice.

The common juniper (*Juniperus communis*) and the Savin (*J. Sabina*), the former in particular, suffer severely from the attacks of a species of well-known fungus, *Gymnosporangia*. This fungus produces the peculiar woody, knob-like swellings which so distort and kill out numbers of specimens of the juniper on our English commons and downs. It spreads with great rapidity, and would seem to have been on the increase of late years, as in the Midland and Southern English counties, large extents of juniper have been almost totally destroyed by its ravages during the past twelve months. When badly attacked with the fungus, the plants wear a rusty, meagre appearance, and gradually die off with the increase of the disease. I have counted as many as seven of these woody swellings on a branch only 4 feet in length, and on a single bush hardly exceeding 8 feet in spread I counted thirty-seven. To the Irish juniper (*J. communis hibernica*) the disease likewise extends. By cutting off the affected shoots, and dressing those on the main stems with fir tree oil, much good has been brought about.

Several species of Pinus, particularly *P. Pinaster*, *P. Strobus*, *P. excelsa*, *P. silvestris*, and *P. montana*, are attacked by *Trametes radiciperda*, the mycelium of which causes the roots and other attacked portions to rapidly decay. In replanting ground from which diseased trees have been removed, the greatest care should be exercised that every portion of the old stump and roots are taken from the ground, the mycelium travelling very rapidly from root to root. The Alaska cypress (*Cupressus nootkatensis*) has been killed outright by the mycelium of Trametes, the disease not only affecting the roots, but the stem and branches. In one particular case the cause was distinctly traced to a piece of plank that by mistake had been left in the soil, and with which one of the larger roots of the cypress had come in contact. The plank was completely enveloped in the mycelium of the fungus. When attacked, the cypress was a healthy vigorous

tree 18 feet high, the first indications of disease being the drooping, sickly appearance of the branch tips. Similar instances of the death of *Sequoia gigantea* and *Araucaria imbricata* by the above fungus could be given.

Several species of *Peridermium* attack and cause much damage to *Pinus insignis*, *P. halepensis*, *P. Strobus*, and *P. montana*. The disease not only causes an inordinate secretion of turpentine, but the cambium of the wood is destroyed, and the branches frequently die off in consequence. Pruning and burning the injured portions of the attacked trees is to be recommended.

*Peridermium columnare* has of late years been very destructive to the silver fir (*Abies pectinata*), less so to the Cephalonian fir (*A. cephalonica*) in several parts of Ireland and elsewhere. When attacked, both the branches and leaves wear a peculiar and conspicuous rusty appearance. Too close growth of the trees is the main cause of attack, and judicious thinning has, in several instances, put a premature end to the spread of the fungus.

*Cedrus Deodara* I have known to be completely killed out by the presence in great quantities of a species of *Polyporus;* and at Ampthill, in Bedfordshire, an unusually large *Cedrus Libani* was badly infested throughout with a similar fungus, and had to be felled in consequence.

The twiggy growths known as "witches brooms" are caused by the mycelium of *Æcidium elatinum*. They are found on *Abies Nordmanniana*, *A. pectinata*, *A. Pinsapo*, *A. balsamea*, *Pseudotsuga Douglasii*, and other conifers. Pruning off and burning affected branches is to be recommended.

When growing in too damp soil, I have known *Cryptomeria japonica*, *Sequoia gigantea*, and *Cupressus macrocarpa*, to have their roots badly injured by the mycelium of a species of *Hymenomycetа;* whilst, again, when planted in unsuitable soils, *Picea morinda*, *Pinus excelsa*, and our common larch, suffer severely from both *Agaricus mellcus* and *Polyporus sulphureus*.

I have known a nursery brake, containing 60,000 one-year-old larches, entirely denuded by the mycelium of a fungus

which undoubtedly had been imported in the leaf-mould and decaying woody matter that had been used for top-dressing, thus showing with what care manures should be added to the soil in which young trees are to be planted.

The common larch suffers to an inordinate extent in Great Britain from the attacks of the now well-known fungus *Peziza Wilkommii*, in fact the wide devastation to large plantations of the tree owing to this cause is little short of a national calamity.

## CHAPTER X.

### VARIABILITY OF CONIFEROUS TREES.

FEW facts in connection with coniferous trees have impressed me more than their extreme variability, whether when growing under the same or different conditions as to soil, aspect, or situation. I have repeatedly known foresters, and other persons who were deeply interested in coniferous trees, quite at a loss to casually recognise on one estate species with which they were perfectly familiar in other parts of the country; and very often it has happened that specimens sent for the purpose of recognition have, owing to a variety of causes, been wrongly named by our greatest authorities on conifer nomenclature. In the latter case I refer directly to foliage, the fruit forming an unerring guide to identity.

The common Scotch pine (*Pinus silvestris*) varies to a wide extent in general aspect, foliage, and size and shape of cones; and the same may be said, though in a greatly increased manner, of the Corsican pine (*P. Laricio*) and its numerous forms. Until quite recently, *P. Laricio austriaca* was ranked as a distinct species, but along the margins of a single plantation at Penrhyn Castle, North Wales, every link between the typical *P. Laricio* and the so-called *P. austriaca* can be seen. How greatly different trees of *P. Strobus* vary in length of foliage and size of cone, a remark that applies with still greater force to the Mexican *P. Montezumæ*. *P. Massoniana*, and *P. parviflora* are other examples of extreme variability, both in aspect and colour of foliage, and specimens of these, growing near the shores of Lough Neagh, in Ireland, are as widely different

from what one sees in the English parks as could well be imagined.

To see *Abies Pinsapo* growing on chalk at High Elms, in Kent, or *Tsuga Canadensis* by the margins of the Drakelow Lakes at Woburn Abbey, their identification with other specimens of the same species, as usually seen, would be a by no means easy task for the amateur. No one, even an expert in conifer nomenclature, would readily reconcile two specimens of *Juniperus communis* collected from one of the Hertfordshire or Kentish commons. Whether in habit, shape, length of leaves, or general foliage tint, different specimens would appear to be widely separated and hardly recognisable unless by the person who studied them on their native downs. But amongst all coniferous trees none would appear to vary more than the justly familiar *Cupressus Lawsoniana*. I have often noticed in a bed of these plants raised from seeds collected from one and the same tree that the variability in general character is truly remarkable. Some are strict and others of decidedly pendulous growth, some are of a dark sombre green as compared with the silvery hue of others, while some are giants and others dwarfs. Both *Abies Nordmanniana* and *A. grandis* vary greatly under cultivation, and some specimens of the former that have been brought under my notice are hardly distinguishable from the common silver fir (*A. pectinata*). Then the bifid foliage of certain stages of growth of *A. firma* has caused much uncertainty and considerable differences of opinion as to the specific rank of this and other nearly allied species.

*A. bracteata*, *A. nobilis*, *A. amabilis*, *A. cephalonica*, *Pseudotsuga Douglasii*, *Sequoia sempervirens*, *Pinus densiflora*, *Tsuga Mertensiana*, *Cupressus Goveniana*, *C. lusitanica*, and various species of *Torreya* and *Cephalotaxus* all wear a remarkable tint of green when growing in Ireland, and which I attribute solely to the humid atmosphere combined with suitable soil.

The wide and marked differences that exist between the juvenile and adult foliage of certain forms of *Juniperus*,

*Cupressus* (including *Retinispora* and *Chamæcyparis*), and *Thuya*, have in many instances led to increased, confused, and erroneous nomenclature. Fortunately, of late years, many doubtful points have been satisfactorily cleared up, and we are now enabled to correctly refer certain previously acknowledged genera to their proper rank of species, and species to that of variety. Notable examples of this kind include *Cryptomeria japonica elegans*, in which only the primordial leaves are produced; the so-called *Retinispora ericoides* and *Biota meldensis*, which are only undeveloped forms of the Chinese arborvitæ (*Thuya orientalis*), in which the scale-like foliage is suppressed; *Thuya Ellwangeriana*, a form of *T. occidentalis* bearing both adult and juvenile foliage; *Retinispora leptoclada*, *R. squarrosa*; and some little-known forms of *Cupressus torulosa* and *Juniperus virginiana*.

Generally speaking, the origin of these forms may be accounted for by the fact that amongst the cypresses, junipers, and arborvitæs, the foliage of seedling plants is long and needle-like, and in many instances, but at indefinite periods, succeeded by scale-like leaves. At what period of their growth this change of foliage may take place is very uncertain, and that too, I have frequently noticed with different conifers from the same batch of seedlings, some assuming the adult foliage at an early date, while others remain in the primordial condition for an almost indefinite period. *Cryptomeria japonica elegans* is an example of the latter kind, the primordial or juvenile character having been retained for thirty years, at present no signs of breaking away from the seedling stage being visible in a specimen of that age. *Retinispora ericoides* (properly *Thuya orientalis ericoides*) is simply an undeveloped form of the Chinese arborvitæ, the fruit, as I have seen, differing in no way from that of the species.

By continual propagation from the juvenile stage a fixed character may therefore be established, and many forms so obtained are highly ornamental and of great value for ornamental purposes; so that the practice amongst conifers is certainly to be recommended. Of *Cupressus torulosa* and *Juni-*

*perus virginiana*, some interesting forms will soon be offered for sale; but the most curious and interesting of any are two pines that would puzzle any conifer lover to define their parentage.

# INDEX.

*Synonyms are indicated by italics.*

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